INTRODUCTION

There has been an increasing awareness of the importance of properly trained Line Service Specialists. Simply put, they are critical to the safe operation of fixed base operators’ refueling activities.

This manual, a resource that accompanies NATA’s Safety 1st Line Service Supervisor And Training Management online training, should serve as the Line Manager’s or Line Supervisor’s guide to training Line Service Specialists. In addition to giving suggestions on training techniques, it also presents guidance on the appropriate times for training as well as topics that should be included in a comprehensive training program.

This manual is not intended to replace the many audiovisual training aids that are available to FBOs. Instead, the goal of this manual is to provide a framework in which those aids can be best utilized.

The manual is divided into four main sections:

1. How to train (page 3.)
2. When to train (page 6.)
3. Training topics (page 9.)
4. Appendices containing forms useful in the training process (Trainer Resources)

Each of these sections contains information that is essential to the proper training of Line Service Specialists.
HOW TO TRAIN

THE IMPORTANCE OF THE TRAINER

You are about to train a new line service specialist. As a supervisor or manager, you are the most important trainer to the employee. Your responsibility is heavy, but it is also a privilege to help people develop new skills.

As the principle trainer, you are the vita to developing a good line service specialist. What you do in the training process will determine how well the individual will perform his or her job in the future. The new line service specialist looks to you for direction; you are the key to his or her future.

Who is a Trainer?

As a trainer, you are --

✦ A Demonstrator -- you show the employee how the skill should be performed.
✦ A Coach -- you help him or her perform the skill correctly.
✦ A Supporter -- you encourage the person to learn, giving support in both success and failure.
✦ A Coordinator -- you train the employee when needed and in the amount that can be handled at that moment.
✦ A Listener -- you listen to questions and concerns as the training process continues.
✦ A Teller -- you tell the employee how to do something, explaining it in terms that can be understood.

In essence, a trainer helps others learn skills that they do not have. The trainer helps an employee move from the time when a skill is new and uncomfortable to the time when a skill is comfortable and automatic.
How Do You Train Others?

Often, learning a new skill is not easy. As the line service specialist learns new skills, s/he will become more comfortable with them. The process of becoming proficient in a new skill moves from the time when the skill seems artificial and uncomfortable to the time when it seems comfortable and automatic. The process of learning a new skill can be summarized as follows:

- First, the employee is uncomfortable and incompetent.
- Then, s/he becomes comfortable with the skill but is still incompetent.
- Next, s/he becomes both comfortable and competent with the skill.
- Finally, the skill becomes automatic and the employee is totally competent.

Your training efforts are aimed at helping others DO. Since the skills of a line service specialist are primarily DOING skills, your training should employ the demonstration method. The following steps are vital to demonstration:

- TELL -- explain the skill, both how and why it is done.
- SHOW -- do it yourself.
- HAVE THEM TELL -- have the employee explain to you how the skill is performed.
- HAVE THEM DO IT -- have he or she perform the skill for you.

Besides a demonstration, there are two other methods often used in training -- lectures and discussions. The lecture is usually used when there is a lot of information to be presented to more than one person. It provides the trainee with general background knowledge. The discussion is useful for drawing out what the trainee does and doesn’t understand.

As a trainer, you should seriously consider utilizing one or more of the audiovisual training aids that are available to you. If you incorporate these aids in your training,
remember, none of them are intended to be your total training program. Rather, they should serve as an excellent means of explaining how and why a skill is performed.

PREPARING FOR TRAINING

Being prepared is essential to proper training. To prepare yourself thoroughly before you start training, follow these steps:

1. Read through the Trainer’s Checklist in the “TRAINING TOPICS” section of this manual. Become familiar with each of the skill areas and the “points to cover” under each skill.

2. For each skill area, think through what, if anything, you’re going to demonstrate and how you’re going to have the employee explain and demonstrate it. Format all this information into a written Lesson Plan.

3. Make a list of any equipment you need. Have all materials you need for the training session before you begin training.

4. Walk through your training for each skill area, including a review of the audiovisual aids you will use.
The Lesson Plan

A written lesson plan is key to preparation before the training process begins. This lesson plan incorporates the OBJECTIVES and METHODS of training. The Trainer’s Checklist presents the groundwork for the development of your specific lesson plans. If you participate in NATA’s Safety 1st PLST Online, use the module instruction plans and training checklists in Appendix B and C of the Trainer’s Guide. Remember this may be found online under the Training Resource page.

Use the information in that checklist to develop the particular objective for each training topic. This is essential because, by establishing clear, concise objectives, you know what to train and the employee knows what is expected of him or her. The more exact the objective, the less likely there will be of any misunderstanding.

Writing out the lesson plan for each training topic, even if the demonstration method is primarily used, helps ensure that no key point is accidentally passed over. It also helps the trainer keep the flow of information moving at a steady pace.

IMPORTANCE OF FEEDBACK

Training does not stop with the end of a formal session; it goes on as the employee learns the skill. During the skill-learning period, it is important that you give the employee positive feedback; this helps the person grow and develop.
Use the following guidelines for giving positive feedback:

1. Don’t argue - subordinates get defensive when you point out faults.
2. Be prepared to listen and understand their point of view.
3. Give frequent feedback on behavior that employees can change, not on the person.
4. Reflect the feelings of the worker.
5. Give timely feedback - give it when the situation occurs, not at a later date.

Positive feedback will help produce a well trained line service specialist -- one that knows the job and serves your customers well.
WHEN TO TRAIN

There are more opportune times to train than others. Some skills need to be learned to serve as a basis for future skills. For the most effective training, carefully plan when to train in each skill area.

You should train...

1. When the person is new and especially anxious to learn the job. At this time, the employee is highly motivated to learn new things that will make him or her effective in the job. This is one of the best times to train people.

2. When the person is ready. This may come after he or she has mastered one set of skills and is ready to go on to the next.

3. When you are ready. Don’t train a person unless you are thoroughly prepared, have all the resources available to make the training most effective and have developed a comprehensive Lesson Plan.

4. When a new procedure is introduced. This is one of the prime training times and should be done immediately.

ESTABLISHING A TRAINING SCHEDULE

Before you begin any training, you should prepare a written schedule for the entire training process. The schedule should include four important dates or time-frames:

1. The period in which initial training will take place
2. A scheduled date for the employee to demonstrate the skill to you
3. A targeted date for the employee to be qualified in the skill
4. Scheduled dates for follow-up instruction

Use the LINE SERVICE SPECIALIST TRAINING SCHEDULE in this manual to establish your training schedule.
When establishing a training schedule, consider the following points:

1. Schedule training in sequence.

2. Schedule training far enough apart for the person to master one set of skills before learning the next.

3. Schedule an appropriate amount of training for each session. Don’t overload the trainee.

After you have made out your schedule for the first time, you may find that you have scheduled a lot of training in the first few weeks. Be realistic and revise your schedule. Remember, don’t overload the trainee.

Once you have developed the schedule, stick to it. Be sure to give the employee a copy.
TRAINING TOPICS

This section includes a TRAINER’S CHECKLIST that presents specific training topics organized within broad areas of training. Each training topic contains suggestions on methods to accomplish the training and points to cover in the training session.

Since some of the points to cover on the CHECKLIST may not apply to your operation, or some needed points are not included, you should modify the list to meet the requirements of your company.

There is a LINE SERVICE SPECIALIST TRAINING RECORD in this manual that contains the same broad training areas and specific training topics as the TRAINER’S CHECKLIST. The RECORD should be used as a checklist of the training provided to each employee. If you participate in NATA’s Safety 1st PLST Online, use the module instruction plans and training checklists in Appendix B and C of the Trainer’s Guide. Remember this may be found online under the Training Resource page. Records should be kept in the personnel file and updated each time you have a training session. This gives you and the employee an ongoing training record and may also serve as a basis for performance appraisal.
TRAINER’S CHECKLIST

Familiarization with Company/Organization
GOAL: to give the employee a complete overview of your operation. Acquaint the person with the key policies, facilities, equipment, relationship to the airport, aviation in general, and customer relations. This part of the training will give the employee the background information needed to function effectively in your company.

Organization/Chain of Command
Introduce the employee to the company, to its internal organization and key employees.

Points to Cover:
* company history
* chain of command
* other company department heads
* parent organization
* __________________________
* __________________________

Rules and Regulations
Relate the rules and procedures of your company. Carefully review with the employee the company employment handbook. (If the employee is issued a handbook, have him sign for it and file the receipt in his personnel file.)

Points to Cover:
* company handbook review
* leaves of absence
* conflicts of interest
* seniority, promotion and transfers
* accident reporting
* work hours
* absence/tardiness
* disciplinary procedures
* learning requirements
* __________________________
* __________________________
Pay Data/Benefits

Explain pay periods, procedures for evaluation of the employee’s work, and employment benefits. Be very specific to avoid future claims of misunderstanding.

**Points to Cover:**

- pay periods
- overtime
- deductions
- raises
- promotions/employee’s future
- holidays and vacation
- disability income plan
- sick, jury, bereavement pay
- retirement plan
- school tuition reimbursement
- workers’ and unemployment compensation
- group medical, dental and life insurance
- sick, jury, bereavement pay
- retirement plan
- sick, jury, bereavement pay
- retirement plan
- school tuition reimbursement
- workers’ and unemployment compensation
- group medical, dental and life insurance

Job Definition

Detail the employee’s job responsibilities. You may also want to give a copy of the job description to the employee.

**Points to Cover:**

- specific responsibilities
- authority

Uniforms/Dress Code

Explain the company’s appearance standards and uniform requirements, including seasonal variations and payment for laundry or cleaning.

**Points to Cover:**

- what the company provides
- uniform/laundry allowance
- what the employee provides
- seasonal clothing requirements
- what the company provides
- uniform/laundry allowance
- what the employee provides
- seasonal clothing requirements
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- seasonal clothing requirements
- what the company provides
- uniform/laundry allowance
- what the employee provides
- seasonal clothing requirements
Company-Owned/Issued Equipment
Explain the value and care requirements for any company-owned equipment the employee will handle on the job.

Points to Cover:
* mandatory hand tools
* loaning company tools to customers
* treatment and respect for company equipment
* surrendering company equipment when employment ends

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Community Relations
Discuss the importance and responsibilities of the fact that, as a line service specialist, the employee is the first person a visitor sees upon his arrival at your city.

Points to Cover:
* the FBO’s role in representing your city
* procedures for handling complaints and irate calls from citizens

______________________________
______________________________

Company Goals
Fully explain the company’s long and short-range goals and how the employee’s job fits into those goals.

Points to Cover:
* long and short-term goals of the company
* the plan for achieving the goals

______________________________
______________________________

Sales Incentives
Detail any incentive payment programs in which the employee can participate.

Points to Cover:
Familiarization with Facility

GOAL: to familiarize the employee with your facility and to determine whether he understands how each part of the company works to accomplish the overall goals. This cannot be done sitting in your office. Instead, walk the employee around the facility.

Ramp Familiarization

Familiarize the employee with the area in which he or she will work.

Points to Cover:

* equipment storage
* transient aircraft parking
* overnight aircraft parking
* tenant aircraft parking
* ramp problems/spots to avoid
* truck and tug parking
* wash rack

Fuel Farm

Identify the fuel storage area and its components. (Detailed training will be given later on fuel farm operation. This is to be a general overview of the operation of the fuel farm.)

Points to Cover:

* location for loading avgas and jet fuel trucks
* familiarization with all valves, pumps, pipes, tanks, and filters
* familiarization with color of products dispensed
* fire and emergency equipment location

Mobile Equipment

Identify the location and use of the ground support equipment used at your facility. (More detailed instructions will be addressed later.)

Points to Cover:

* fuel truck familiarization
* tug familiarization
* other equipment

Other FBO Departments
Explain the role of each department in your FBO and identify the key employees in each department.

Points to Cover:
* location of departments
* times of normal operation
* products carried and maintained
* key personnel
* personnel on call after hours

Hangars
Identify hangar locations and operation.

Points to Cover:
* location
* types of aircraft stored
* stacking
* door operation
* winter operation
* location/operation of heat, water, lights, power

Services Offered
Demonstrate how to communicate with customers about the services offered by your FBO.

Points to Cover:
* products and services provided by line operation
* products and services offered by other departments
* local attractions

Customer Facilities
Explain what facilities are available to pilots and passengers from your FBO and the local area.

Points to Cover:
* facilities offered only to pilots
* facilities available to passengers
* local attractions
Familiarization with Airport
GOAL: to familiarize the employee with the airport on which he will be working, including its rules and regulations.

Airport Layout
Relate the layout of the airport, including location of emergency services. Identify areas outside of your company’s leasehold which the employee must access.

Points to Cover:
* fire department
* airport authority location
* perimeter road
* access gates
* runways and taxi-ways
* wind sock location

* terminal layout
* other FBOs
* other non-FBO lessees

Security Regulations/Personnel
Explain the airport rules and regulations concerning security and the reporting procedures concerning security violations.

Points to Cover:
* security personnel
* access regulations
* reporting security breeches

Air/airport/FBO Relationship
Explain the importance of maintaining a good relationship between the airport and your FBO. Identify the FBO’s responsibilities under your airport lease agreement.

Points to Cover:
* attitude of airport toward your FBO
* importance of mutually beneficial relationship
* airport management structure
* company efforts to maintain good relationship

Driving Regulations
Relate the importance of safe operation of any vehicle on the airport.
Points to Cover:
* specific driving regulations
* rights-of-way
* prohibited areas
* penalties
* ________________________________
* ________________________________

Airport Rules
Relate airport rules other than those concerning security or driving.

Points to Cover:
* ________________________________
* ________________________________
* ________________________________

Tenant Location/Services
Identify other airport tenant’s locations and services offered. Explain how to communicate this information to interested customers and visitors.

Points to Cover:
* other FBO locations
* services offered by other FBOs
* superiority of your services
* other non-FBO tenants’ locations and services
* ________________________________
* ________________________________
Familiarization with Emergency Procedures

GOAL: to teach the line service specialist exactly what to do in an emergency situation. Be very careful in your training and thoroughly walk through the procedures, answering any questions the employee has.  This training is crucial.

Fuel Spills

Explain reporting and response procedures.

Points to Cover:

* reporting procedures
* clean-up procedures
* personal safety

Fires

Explain fire potential, reporting procedures, and demonstrate the use of fire extinguishers.

Points to Cover:

* fire characteristics of fuel
* emergency shut-off system
* personal safety
* reporting procedures
* operation of fire extinguishers

Injuries/First Aid

Discuss basic first aid, response and reporting procedures.

Points to Cover:

* first aid kit location/use
* emergency telephone numbers
* hospital/clinic location
* reporting procedures
* employees with CPR training
* eye wash kit location/use
* shower location
* reporting procedures

Hangar Rash

Identify the causes, cost, prevention, and repercussions of hangar rash.

Points to Cover:

* causes of hangar rash
* hangar stacking procedures
* payment for hangar rash
* reporting procedures

Natural Disasters
Explain company procedures.

**Points to Cover:**
- company procedures
- emergency telephone numbers
- media relations
- personal safety

**Bomb Threats/Personal Threats**
Explain established procedures.

**Points to Cover:**
- company procedures
- emergency telephone numbers
- evacuation procedures
- media relations

**Hazardous Materials**
Explain how to identify hazardous materials and demonstrate how each is properly handled.

**Points to Cover:**
- handling procedures
- handling hazardous cargo
- spill/leak procedures
- personal safety
- recognition of hazardous materials
- hazardous materials used in the company

**Emergency Telephone Numbers**
Identify emergency telephone numbers and proper reporting procedures.

**Points to Cover:**
- location of list
- contents of list
- reporting procedures

**Accident Reporting**
Explain company policies and reporting procedures.

**Points to Cover:**
- reporting procedures for different types of accidents
Media Relations
Explain the company media relations policy; introduce trainee to the company spokesman.

Points to Cover:
* company policy
* identification of spokesman

Aircraft Theft
Explain company policy and demonstrate theft prevention techniques.

Points to Cover:
* hangar security
* tie down/T-hangar security
* reporting procedures
* opportunities to prevent theft

Disabled Aircraft
Identify and demonstrate procedures for removing disabled aircraft.

Points to Cover:
* passenger/baggage unloading
* movement procedures

Snow/Ice Removal
Demonstrate proper removal procedures.

Points to Cover:
* FBO’s removal responsibility
* airport’s removal responsibility
* airport removal contact
* equipment
**Familiarization with Aviation**

GOAL: to provide the line service specialist with a complete overview of the whole field of aviation as it applies to the line service area.

**Terminology**

Identify and explain the terminology unique to aviation.

* **Points to Cover:**
  * acronyms
  * line department terminology
  * other department terminology
  * pilot jargon
  * ____________________________
  * ____________________________

**Importance of Fueling to Safe Flight**

Explain the importance and the critical nature of clean, dry fuel to the safe operation of aircraft, as well as the effects of unsafe fueling.

* **Points to Cover:**
  * differences between aircraft and automobile fuel requirements
  * cost of accidents due to bad fuel
  * potential for loss of life
  * ____________________________
  * ____________________________

**Value of Aircraft**

Identify the value of the equipment the employee will be servicing and the cost of repair.

* **Points to Cover:**
  * costs of different aircraft
  * ____________________________

**Aircraft Identification**

Demonstrate the difference between piston and turbine powered aircraft.

* **Points to Cover:**
  * characteristics of piston-engine aircraft
Radio Operation
Demonstrate company radio, UNICOM, and ARINC radio operations.

**Points to Cover:**
* company radio operation
* radio dispatch of service vehicles
* UNICOM operation
* airport advisories
* ARINC operations
* radio operation while fueling
* __________________________
* __________________________

Fuel Identification
Identify and demonstrate the difference between different grades of fuel.

**Points to Cover:**
* avgas color, feel
* avgas grade(s)
* jet fuel color, feel
* jet fuel grades
* fuel specifications
* __________________________
* __________________________

Customer Relations
GOAL: to give the employee a thorough understanding of his or her role as a salesman for the company, and the importance of proper handling of customers.

**Professionalism**
Give examples of the professional nature of line service operations and a basic understanding of the customers’ expectations for professional service. Explain why professional self-image of the employee is important.
Points to Cover:
  * training required to become qualified specialist
  * complex machinery to operate
  * sophisticated procedures to follow
  * complex equipment to service
  * employee’s value to company

Attitude
Demonstrate how a positive attitude is a key to successful line operation.

Points to Cover:
  * importance of attitude to advancement
  * customer expectations
  * supervisor’s expectations

Personal Appearance
Explain how employee’s appearance impacts customers; identify the company’s policy on personal appearance.

Points to Cover:
  * professional nature of job
  * employee’s responsibility as image of company
  * company uniform policy
  * company personal appearance policy
  * name badges/I.D.

Housekeeping
Explain how the appearance of the facility impacts customers; identify the company’s policy and procedures to ensure professional appearance.

Points to Cover:
  * customers expectations
  * housekeeping assignments
  * impact of neat operation on safety

Customer Expectations
Explain the importance of familiarity with typical customer requirements; demonstrate how to prepare for extraordinary requests.

Points to Cover:
* normal customer requests
* extraordinary customer requests
* procedure for filling requests
* sources for services/products beyond the scope of your operation

Familiarization with Regular Based and Transient Customers
Identify based customers’ location, corresponding requirements, and the needs of regular transient customers.

**Points to Cover:**
* based customers’ hangar/tie down location
* based customers’ regular requirements
* unique handling requirements for specific based customers
* service typically required by regular transient customers

Complaints
Identify your company’s procedures for dealing with customer complaints.

**Points to Cover:**
* proper attitude
* listening skills
* corrective action
* reporting procedures

Other Customer Services
Identify services provided to special customers and those services not provided on a regular basis.

**Points to Cover:**
* 
* 
*
Sales Procedures
GOAL: to ensure the employee knows the pricing and payment policies of your company.

Pricing
Identify all related taxes and fees that are included in your prices and the prices of other services your company offers.

Points to Cover:
* components of the retail price of fuel
* federal excise tax on fuel
* state/local taxes
* discount structure
* landing fees
* retail price of other products and services

Payment Methods
Identify payment methods accepted by your company and explain all associated procedures.

Points to Cover:
* types of payment accepted
* credit cards accepted
* credit card acceptance procedures
* military and other governmental sales
* check acceptance procedures

Introduction to Quality Control
GOAL: to provide a basic understanding of the care that must be given to aviation fuels. More specific training will be provided on fuel farm and fueling equipment operation.

Fuel Distribution Overview
Demonstrate the steps aviation fuel goes through and the care it receives before it reaches aircraft.

Points to Cover:
* refining
* bulk storage
Fuel Identification
Demonstrate the difference between grades of fuel.

**Points to Cover:**
- avgas color, feel
- avgas grade(s)
- jet fuel color, feel
- jet fuel grades
- fuel specifications
- _______________________
- _______________________

Contaminants
Explain how to identify contaminants in fuel and the reporting and response procedures used when contaminated fuel is identified.

**Points to Cover:**
- solid contaminants
- water in fuel
- microbial growth
- surfactants
- product mixture
- reporting procedures
- response procedures
- _______________________
- _______________________

Filtration
Identify and demonstrate the use of fuel farm and mobile equipment filtration equipment.
Points to Cover:
  * theory of filtration
  * fuel farm filtration equipment
  * refueler filtration equipment

Safety
GOAL: to ensure the employee has a full understanding and appreciation of the need to follow established safety procedures. The employee should fully understand the basic line service rule “If you don’t know, don’t do it.”

Static Electricity/Grounding/Bonding
Demonstrate the effects of static electricity and means to protect against it.
Points to Cover:
  * generation of electricity
  * bonding procedures
  * grounding procedures (if applicable)
  * location of grounding rods (if applicable)

Fire Safety
Explain areas of fire potential and how to prevent fires; identify fire extinguishers’ location and demonstrate their use.
Points to Cover:
  * fire tetrahedron
  * sources of ignition
  * fire extinguisher location/use
  * emergency shut-off location/use
  * smoking policy

Lightning/Severe Weather
Discuss the potential danger of fueling in the presence of lightning and the company’s procedures regarding severe weather operations.
Points to Cover:
  * fueling in electrical storms
  * securing aircraft in severe weather
  * personal safety
Leaks and Spills
Identify the sources of fuel leaks and spills, how to prevent each, and demonstrate clean-up procedures.

**Points to Cover:**
- spill sources
- spill hazards
- reporting procedures
- clean-up procedures
- emergency phone numbers
- personal safety

Hand Signals
Demonstrate all hand signals used in line operations.

**Points to Cover:**
- fixed wing aircraft signals
- helicopter signals
- night procedures/equipment

Jet Blast
Explain the danger of jet engine operation and identify safety procedures for working around jet aircraft.

**Points to Cover:**
- jet exhaust velocity/location
- safety of others on the ramp
- driving/walking around jet aircraft

Propeller Safety
Discuss the dangers of both moving and stationary propellers and precautions to avoid injury.

**Points to Cover:**
- deadly nature of propellers
- potential for propellers starting without engine running
- chocking procedures to avoid propellers
Rotors Safety
Identify the dangers of helicopter rotors and precautions to avoid injury.

**Points to Cover:**
* rotor sag
* tail rotor dangers
* downwash

Night Operations
Identify the dangers of night ramp operations and explain the need for increased safety precautions.

**Points to Cover:**
* reduced visibility
* driving procedures
* reflective clothing/vests

Foreign Object Damage
Discuss how foreign objects on the ramp can cause damage.

**Points to Cover:**
* sources of FOD
* damage caused by FOD
* ramp clean-up procedures

Hearing/Eye Protection
Explain the need to protect ears and eyes and identify the company’s policy regarding ear and eye protection.

**Points to Cover:**
* dangers from jet/prop/rotor wash
* effects of jet noise
* use of sound attenuators
* use of eye protection
* other company issued safety equipment
Passenger Safety
Explain the potential dangers that exist for ramp visitors.

**Points to Cover:**
* sources of danger
* policy regarding ramp visitors
* employer’s responsibility/liability

Clothing
Demonstrate how certain types of clothing, shoes, and jewelry can create a safety hazard.

**Points to Cover:**
* static generation of clothing
* dangers of metal on shoe soles or heels
* jewelry as FOD
* contents of top pockets as FOD
* contents of top pockets falling into fuel tanks

Chocking/Securing Aircraft
Demonstrate the need to secure aircraft and proper chocking/tie-down procedures.

**Points to Cover:**
* types of tie-downs
* tie-down ropes/cables/chains
* tie-down procedures
* chocking procedures
* control locks
* protective covers
* rotor/propeller tie-downs

Hazardous Materials
Identify and demonstrate proper handling of hazardous materials.

**Points to Cover:**
* hazardous materials used in the company
* recognition of hazardous materials
* handling procedures
* handling hazardous cargo
* spill/leak procedures
* personal safety
* emergency phone numbers
Fuel Farm
GOAL: to ensure the employee has a full understanding of the location, operation and maintenance of the fuel farm.

Physical Layout of Fuel Farm
Identify the location of each component of the bulk storage area.

**Points to Cover:**
- marking
- storage tanks
- floating suction
- piping
- valves
- filtration equipment
- pumps
- meters
- grounding reels
- hoses/nozzle
- gauging pipes
- waste tanks
- vent lines
- emergency shut-offs
- __________________________
- __________________________

Operation of Filtration System
demonstrate the operation of the fuel farm filtration equipment.

**Points to Cover:**
- filter and filter/separator operation
- differential pressure
- water slug valves
- strainers
- __________________________

Maintenance of Filtration System
Identify and demonstrate the maintenance procedures for the fuel farm filtration system.

**Points to Cover:**
- routine filter changes
- non-routine filter changes
- water slug valves
- filter vessel cleaning
- __________________________

Receipt Procedures
Identify company procedures for receiving fuel into the fuel farm.

**Points to Cover:**
* comparing bill of lading with order
* checking for proper load
* gauging receiving tank
* clear and bright/white bucket tests
* inspecting off-loading hoses
* connecting bonding cables
* setting valves

* unloading truck
* checking differential pressure
* checking truck compartments
* gauging receiving trucks
* resetting valves

Storage Procedures
Explain the importance of proper care of product in storage.

Points to Cover:
* settling time
* visual inspections
* water detection
* sump tanks
* clear and bright/white bucket tests
* floating suction checks
* tank vent checks
* differential pressure checks

Quality Control Tests
Identify the purpose of quality control tests; demonstrate acceptable test results.

Points to Cover:
* clear and bright test
* white bucket check
* water detection test
* membrane filtration test
* specific gravity test
* water separation test

Delivery to Mobile Fueling Equipment
Identify and demonstrate required procedures for transferring fuel to mobile fueling equipment.

Points to Cover:
* bonding
* use of deadman controls
* top-loading
* bottom-loading
* emergency shut-offs

* fire safety

Recordkeeping
Explain company policy concerning fuel farm recordkeeping and the need for adequate records.

Points to Cover:
* purpose of records
* daily records
* other records

Waste Disposal
Identify the ecological implications of improper waste disposal and explain the company’s waste disposal procedures.

Points to Cover:
* disposal of fuel samples
* disposal of used oil
* disposal of other wastes

Spill Prevention/Clean Up
Explain the company’s spill prevention plan and demonstrate established clean-up procedures.

Points to Cover:
* spill prevention plan
* reporting procedures
* clean-up procedures
* ____________________________
* ____________________________

Leak Detection/Inventory Control
Explain company’s inventory control program and demonstrate leak identification procedures.

Points to Cover:
* regulatory requirements
* company’s liability for leaks
* daily inventory reconciliation program
* ecological signs of leaks
* ____________________________
* ____________________________

Housekeeping
Explain the importance of proper fuel farm housekeeping to safety and demonstrate proper housekeeping procedures.

**Points to Cover:**
* company policy
* housekeeping assignments
* ____________________________
* ____________________________

Security
Identify fuel farm security requirements.

**Points to Cover:**
* fencing
* lighting
* operation of security systems
* company/airport security regulations

Mobile Fueling Equipment
GOAL: to have the employee successfully demonstrate the operation and maintenance of mobile fueling equipment.

Safety Equipment
Demonstrate the use of safety equipment on mobile refuelers and associated safety procedures.

**Points to Cover:**
* anti-misfueling hardware  
* fire extinguishers  
* brake interlocks  
* smoking policy  
* ____________________________  
* ____________________________

Driving
Identify and demonstrate unique characteristics of driving mobile refuelers.

**Points to Cover:**
Operation and Maintenance of Fuel Dispensing System

Explain the mobile fuel dispensing system and the importance of periodic operational checks.

**Points to Cover:**
- visual checks
- dome covers
- meters
- bonding cables
- static and pressure leak checks
- filter/separators
- differential pressure checks
- sump drains
- hoses and reels
- nozzles and screens
- dead-man controls
- water detection shut-off valves

Quality Control Tests

Demonstrate all fuel quality tests and explain how to interpret the results.

**Points to Cover:**
- clear and bright tests
- white bucket tests
- membrane filtration tests
- water detection tests
- water detection tests

Recordkeeping

Explain company policy concerning mobile refueling equipment recordkeeping and the importance of adequate records.

**Points to Cover:**
- purpose of records
- quality control records
* maintenance records
* other records
* ____________________________________________
* ____________________________________________

**Truck Maintenance**
Identify and demonstrate required preventive maintenance procedures.

**Points to Cover:**

- vehicle appearance
- engine oil
- engine coolant
- exhaust system
- lights
- air reservoir tanks
- tires
- brakes
- battery
- electrical system
- ____________________________________________
- ____________________________________________
### Other Ground Service Equipment/Procedures

**GOAL:** to recognize the use and care of all ramp service equipment.

#### Tugs

Demonstrate how to successfully operate tugs safely.

**Points to Cover:**

- * safety checks
- * driving characteristics

#### Tow Bars

Demonstrate the proper use of all tow bars at your facility.

**Points to Cover:**

- * tow bar operation
- * identification of proper tow bars

#### Ground Power Units

Explain how to successfully connect and use a GPU.

**Points to Cover:**

- * towing/driving
- * connecting
- * starting/stopping
- * disconnecting
- * servicing
- * safety checks

#### Engine Heaters

Demonstrate how to connect and operate engine heaters.

**Points to Cover:**

- * towing/driving
- * connecting
- * starting/stopping
- * disconnecting
- * servicing
- * safety checks
De-Ice Truck
Demonstrate how to properly operate de-ice equipment.

* Points to Cover: *
  * driving
  * operation
  * de-ice procedures

Lav Service
Demonstrate how to properly service aircraft lavatories.

* Points to Cover: *
  * driving
  * connect points
  * operation
  * discharge location/procedures

Courtesy Vehicles
Explain the use of courtesy vehicles and demonstrate proper operation of those vehicles.

* Points to Cover: *
  * driving
  * customer use policy
  * maintenance checks
  * vehicle appearance

Follow-Me Vehicles
Demonstrate how to safely operate follow-me vehicles.

* Points to Cover: *
  * driving
  * giving directions to aircraft
  * maintenance checks
  * vehicle appearance

* safety checks

* safety checks

* safety checks
Fueling Aircraft
GOAL: to give the employee a thorough understanding of procedures for fueling all aircraft that frequent your operation.

Meeting and Greeting the Aircraft
Explain the importance of the first contact with the pilot and passengers.

* parking/chocking aircraft
* unloading passengers
* positioning fueling vehicle

Taking the Order
Identify proper order-taking procedures.

* contents of the order form
* confirming fuel grade
* selling additional services
* disposition of the order form

Grounding and Bonding
Demonstrate proper grounding and bonding procedures.

* reasons for grounding and bonding
* bonding points
* bonding procedures
* grounding rod location (if applicable)
* grounding procedures (if applicable)
* bonding the nozzle
Reciprocating Engine Aircraft
Identify and demonstrate proper fueling procedures for reciprocating single and multiengine aircraft.

Points to Cover:
* safety
* aircraft identification
* bonding and grounding (if applicable)
* tank filler locations
* ensuring proper product
* use of ladders
* use of wing mats
* types of fuel caps
* types of fuel tanks
* fueling procedures
* tank sequence
* preventing damage from hoses and nozzles
* disconnect procedures
* securing fuel caps

Turboprop Aircraft
Identify and demonstrate proper fueling procedures for turboprop aircraft.

Points to Cover:

Over-the-Wing
* safety
* aircraft identification
* grounding and bonding
* tank filler locations
* ensuring proper product
* use of ladders
* use of wing mats
* types of fuel caps
* types of fuel tanks
* fuel additives
* fueling procedures
* tank sequence
* preventing damage from hoses and nozzles
* disconnect procedures
* securing fuel caps

* * *
* * *
**Single Point**

- safety
- aircraft identification
- fueling points
- ensuring proper product
- connect procedures
- pumping pressure
- fuel additives
- fueling procedures
- air vents
- gauges
- disconnect procedures

**Jet Aircraft**

Identify and demonstrate proper fueling procedures for jet aircraft.

* **Points to Cover:**

  * **Over-the-Wing**
    
    - safety
    - aircraft identification
    - bonding and grounding (*if applicable*)
    - tank filler locations
    - ensuring proper product
    - use of ladders
    - use of wing mats
    - types of fuel caps
    - types of fuel tanks
    - fuel additives
    - fueling procedures
    - tank sequence
    - preventing damage from hoses and nozzles
    - disconnect procedures
    - securing fuel caps
    - _____________________
    - _____________________

  * **Single Point**
    
    - safety
    - aircraft identification
    - bonding and grounding (*if applicable*)
    - fueling points
    - ensuring proper product
    - connect procedures
    - pumping pressure
    - fuel additives
    - fueling procedures
    - air vents
    - gauges
    - disconnect procedures
    - _____________________
    - _____________________
Helicopters
Identify and demonstrate proper fueling procedures for helicopters.

Points to Cover:

* safety
* bonding and grounding (if applicable)
* ensuring proper product
* types of fuel tanks
* types of fuel caps
* tank location
* fuel additives
* fueling procedures
* disconnect procedures

Defueling
Identify and demonstrate proper defueling procedures.

Points to Cover:

* reason for defueling
* defueling procedures
* storage of defueled product
* disposition of defueled product

Quick Turn
Explain company procedures for quick servicing of aircraft.

Points to Cover:

* procedures

Fuel Additives
Identify the purpose of fuel additives and demonstrate how to inject additives.

Points to Cover:

* types of additives
* personal safety
* use of additives
* injection procedures
Lubricants
Explain the purpose of different types of lubricants and demonstrate how to check and add lubricants.

Points to Cover:
* types of oils
* checking oil levels
* ensuring proper oil
* adding oil
* securing caps

Chocking -- Aircraft and Truck
Explain the importance of chocking aircraft and vehicles and demonstrate proper chocking procedures.

Points to Cover:
* purpose of chocks
* types of chocks
* chocking procedures

Towing
GOAL: to have the employee demonstrate a thorough understanding of towing procedures; appreciation of responsibilities and tow driver and wing walkers; and familiarity with towing equipment.

Equipment
Explain the importance of the safe use of towing equipment.

Points to Cover:
* hand tractors
* tow tractors
* towing lugs
* tow bars
* draw bar pull ratings
* inspection and maintenance procedures
Procedures
Demonstrate proper towing procedures

Points to Cover:
- tow driver’s responsibilities
- equipment selection
- attaching tow bars
- attaching tractors
- preparing aircraft
- turning propellers by hand
- wing walkers
- communication between tow driver and wing walkers
- pushing procedures
- pulling procedures
- nosegear turn limits
- aircraft turn radius
- vertical clearance
- speed limits
- night procedures
- inclement weather procedures
- hangar stacking
- securing aircraft
- accident reporting

Other Aircraft Services
GOAL: to give the employee an understanding of other services provided by the company and the ability to perform those services.

Window Cleaning
Demonstrate how to safely and properly clean aircraft windows.

Points to Cover:
- windshield type
- cleaning equipment
- cleaning procedures

Oxygen Service
Demonstrate how to safely service aircraft oxygen systems.

Points to Cover:
- identifying oxygen bottles
- servicing equipment
- servicing procedures
- fire safety
- securing bottles

Tire Service
Identify proper tire condition and demonstrate how to safely service tires.

Points to Cover:
* recognizing tire wear
* identifying nitrogen bottles
* servicing equipment
* servicing procedures
* securing bottles

Aircraft Cleaning and Washing
Explain proper cleaning procedures and demonstrate how to properly clean and wash an aircraft.

Points to Cover:
* cleaning agents
* cleaning equipment
* interior cleaning
* cleaning instruments
* exterior cleaning
* waxing
* wash racks

Catering
Identify the company’s catering abilities and demonstrate associated procedures.

Points to Cover:
* catering offered
* ordering procedures
* coffee / ice service
* ___________________
Trainer Resources
NATA Safety 1st Supervisor/Trainer Resources

- FAA Advisory Circulars – The FAA issues advisory circulars to inform the aviation public in a systematic way of non-regulatory material. Unless incorporated into a regulation by reference, the contents of an advisory circular are not binding on the public. Advisory circulars are issued in a numbered-subject system corresponding to the subject areas of the Federal Aviation Regulations (FAR’s) (Title 14, Code of Federal Regulations, Chapter I, Federal Aviation Administration). An AC is issued to provide guidance and information in a designated subject area or to show a method acceptable to the Administrator for complying with a related Federal Aviation Regulation.
  
  http://www.faa.gov/regulations_policies/advisory_circulars/
  AC 00-34A – Aircraft Ground Handling and Servicing
  AC 20-35C – Tie-down Sense
  AC 20-122A – Anti-misfueling Devices: Their Availability and Use
  AC 91-13C – Cold Weather Operation of Aircraft
  AC 150/5230-4B – Aircraft Fuel Storage, Handling and Dispensing on Airports
  AC 150/5230-20 - Ground Vehicle Operations on Airports

- FAA Airports –
  http://www.faa.gov/airports/

- FAA CertAlerts -
  http://www.faa.gov/airports/airport_safety/certalerts/

- FAA Runway Safety -
  http://www.faa.gov/airports/runway_safety/

- NATA’s Safety 1st Operational Best Practices (OBPs) – NATA log-in required

- NATA seminars -
  http://www.nata.aero/Events/Seminars.aspx

- NATA webinars -
  http://www.nata.aero/Events/Webinars.aspx

- NFPA 407 -
  http://www.nfpa.org/aboutthecodes/AboutTheCodes.asp?DocNum=407&cookie%5Ftest=1

- OSHA Resources -
  http://www.osha.gov/
Anti-Icing Additive

INJECTOR GUIDANCE FROM THE MANUFACTURERS

Hammonds and Gammon Technical Products developed specific injector and maintenance guidance for your use. Additionally, Air BP Aviation and ChevronTexaco recommend that you refer to the MSDS and wear appropriate PPE.

PREVENTATIVE MAINTENANCE CHECKLIST

HAMMONDS MANUAL AND “SMART” MODEL 600 PRIST® INJECTORS

1. Check additive supply daily and inspect desiccant dryer. If dryer is more than three quarters pink, replace the element.
2. Always wear gloves and goggles when handling additive or servicing your additive system.
3. Inspect entire system monthly for leaks including all fittings on additive tank, delivery and injection lines, calibration gauges and additive pump.
4. Inspect and clean screens in Sight Flow Indicators and filters in additive lines in “Smart” systems monthly.
5. Check pump stroke adjustment setting monthly, should be about 60% and knob should be tight. Knob should not move when operating.
6. Change diaphragm annually. Follow factory recommendations for procedures.
7. Be certain system has 25 PSI check valve on calibration output port before calibrating to atmosphere in an open container.
8. If additive supply is incorrectly installed below injector, consult Hammonds for special instructions.
9. Visually check for additive flow through Sight Flow indicator, Suction Calibration gauge or digital additive meter during each use.
10. Check calibration of any additive system every 90 days.
11. Consult Hammonds for free assistance in operating and maintaining your Hammonds additive system. 800-582-4334 – website hammondscos.com

GAMMON TECHNICAL PRODUCTS – OFFERS GUIDANCE ON INJECTOR USAGE

Gammon Technical Products makes three additive injectors, the Digital Viper, Viper Eclipse and Viper Stealth. Gammon Technical also has made an older design. This injector has an air-operated valve, connected by tubing, on the side of the meter register.

If you have this unit, the GTP-2276, contact Gammon Technical directly at gammontech@gammontech.com.

The following manuals are simple operating manuals. Installation manuals are also available by going to: http://www.gammontech.com/mainframe/Pmanuals.htm

What Viper do you have?

Digital Viper - No display, has a simple control box with no lights or switches.

Viper Eclipse - Rectangular shaped digital display, 4-1/4” x 2-3/8”, mounted in a S/S control box with two red lights, one green light, one selector switch and one push button switch.

Viper Stealth - Square shaped display, 3-3/4” x 3-3/4”, mounted in a fiberglass control box with one red indicator light and no switches.

Viper Operation Manual

Operation:

1. Verify whether or not the aircraft to be refueled needs additive injected into the fuel.
2. Verify that there is a sufficient amount additive in the reservoir to complete the refueling operation.
3. Turn the air supply valve to the on position.
4. Turn the Inject/Test valve to INJECT.
5. The aircraft can now be refueled.
6. Watch the sight flow indicator to verify that additive is flowing.
7. When the refueling operation is complete, turn the air supply valve and the Inject/test valve each to the off position.

Do not guess, call the factory.
**Viper Calibration:**

1. Set the truck up to re-circulate fuel.
2. Turn the air supply valve to the on position.
3. Turn the Three-way TEST/INJECT valve to TEST.
4. Place a graduated cylinder under the test port tubing.
5. Flow fuel thru the truck until there is no air coming out of the test port.
6. Empty the graduated cylinder. Place it under the test port.
7. Flow 100 gallons of fuel thru the truck.
8. Verify that 380 ML of additive has flowed into the graduated cylinder.
9. This should be done several times to verify the amount.

**Viper Eclipse Operation Manual**

**Description:** The Viper Eclipse additive injection system is a self-monitoring and self-adjusting additive injection system. The system was designed so the operator has to make a decision to inject additive or not to inject additive each time an aircraft is refueled. Each time the vehicle is moved, the additive injection system is reset. The vehicle now cannot pump fuel until the operator selects either additive or no additive. A display is provided to show the actual injection rate in parts per million and percent of additive. A second screen on the display will show gallons or Liters of fuel pumped and gallons or Liters of additive injected.

**Operation:**

1. Verify whether or not the aircraft to be refueled needs additive injected into the fuel.
2. Verify that there is a sufficient amount of additive in the reservoir to complete the refueling operation.
3. Use the selector switch on the control box to either select additive or no additive. This will enable the vehicle to pump fuel. The selector switch is not an OFF/ON switch for the injection system. If the wrong selection is made, the vehicle must be turned off and restarted. The only way the system can be manually turned off is to turn off the ignition switch of the vehicle. The system will automatically turn off when the vehicle is moved.
4. The aircraft can now be refueled.
5. If the system shuts down the vehicle, look at the warning lights on the control box to determine whether too much or too little additive was injected. Make a note of the parts per million of additive injected and the number of gallons/Liters of fuel pumped. If no additive was injected, verify that all of the valves installed in the additive lines and air lines are turned on, and that there is additive in the reservoir. Press the reset button to restart the system.

**Calibration:** If there is a problem with the calibration contact Gammon Technical.

1. Set the truck up to re-circulate fuel.
2. Select additive on the control box.
3. Turn the Three-way TEST/INJECT valve to TEST.
4. Place a graduated cylinder under the test port tubing.
5. Flow fuel thru the truck until there is no air coming out of the test port.
6. Press the reset button on the control box. This will reset the display to 0.
7. Empty the graduated cylinder. Place it under the test port.
8. Flow 350 to 450 Liters of fuel thru the truck.
9. Compare the amount of additive in the graduated cylinder, to the amount that is shown on the GALLONS of ADDITIVE display.
10. This should be done several times to verify the amount.
11. Turn the TEST/INJECT valve to INJECT.

**Operation of the display unit:** The display unit is set up so that only two screens are accessible to the operators. All of the settings in the PLC are protected by a password. This password is needed to make any changes to the program.

1. Use the selector switch on the control box to select additive.
2. The display will turn on.
3. When ready, the display will show the percent and parts per million of additive.
4. Press the NEXT button on the display to go to the next screen. This will show Liters of fuel and liters of additive. Press the PREV button to return to the first display.

**Viper Stealth Additive Injection**

*Operation:*

1. Turn on the power. The display on the control panel should turn on.

2. Verify that the three-way inject/test valve is in the inject position.

3. Verify that the additive reservoir has sufficient additive. The minimum amount of additive to be injected is 1 gallon for every 1000 gallons of fuel.

4. Press the #2 button on the control panel key pad. This will activate the additive pumps and prepare the system to start injecting additive.

5. Verify that the additive pumps are running and the display shows fuel and additive information.

6. Start the flow of fuel.

7. When finished, turn off the power to the additive system.

If the system is not injecting the correct amount of additive, a red indicator light will be activated.

The control panel display will show the total number of gallons of additive injected, the total number of gallons of fuel loaded, the parts per million of additive injected and the percent of additive injected. This information will be stored in the memory of the display with a time and date stamp.

*Calibration:*

1. Turn on the power.

2. Press the right arrow button until you get to the password screen.

3. Press the enter button. Enter the password and press enter.

4. Press the right arrow button until you see the calibration screen.

5. Turn the three-way test valve to test.

6. Press enter.

7. Place a graduated cylinder under the test port.

8. Press and hold the 0 button. Flow at least 600 ml into the container. Release the 0 button.

9. Compare the ml of additive in the container to the amount shown on the display.

10. If the amounts are not the same, call Gammon Technical for instructions.

11. Press the enter button to turn off the additive pumps.

12. Press the right arrow button to go to the select additive screen.

**To view previous fueling information:**

1. Turn on the power.

2. Press the right arrow button until you get to the password screen.

3. Press the Enter button. Enter the password, press the Enter button.

4. Press the Up or Down button until you see the time and date of the previous fueling.
Please note there are containers that are in service on dispensing equipment, specifically stainless steel containers, that do not fall into the following listed categories. When handling additive, be sure to read the manufacturer’s MSDS and wear appropriate personal protective equipment (PPE).

### Quick Guide to Additive Dispensed

<table>
<thead>
<tr>
<th>55 Gallon Vertical Drum</th>
<th>5 Gallon Plastic Jug</th>
</tr>
</thead>
<tbody>
<tr>
<td>Record level in height of liquid from bottom of drum in inches with fractions in decimal form</td>
<td>Record level in height of liquid from bottom of jug in inches with fractions in decimal form</td>
</tr>
<tr>
<td>A) Starting level _________”</td>
<td>A) Starting level _________”</td>
</tr>
<tr>
<td>B) Ending Level _________”</td>
<td>B) Ending Level _________”</td>
</tr>
<tr>
<td>C) Subtract B from A = _________”</td>
<td>C) Subtract B from A = _________”</td>
</tr>
<tr>
<td>D) C x 1.75 = _________ gallons dispensed</td>
<td>D) C x .43 = _________ gallons dispensed</td>
</tr>
</tbody>
</table>

(A 55-gallon drum (22.5” ID) holds about 1.75 gallons per inch of height.)

(A 5-gallon jug (11.25” ID) holds about .43 gallons per inch of height.)

### Conversion chart: Fractions to Decimal

<table>
<thead>
<tr>
<th>Fraction</th>
<th>Decimal</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/8”</td>
<td>.125”</td>
</tr>
<tr>
<td>1/4”</td>
<td>.25”</td>
</tr>
<tr>
<td>3/8”</td>
<td>.375”</td>
</tr>
<tr>
<td>1/2”</td>
<td>.5”</td>
</tr>
<tr>
<td>5/8”</td>
<td>.625”</td>
</tr>
<tr>
<td>3/4”</td>
<td>.75”</td>
</tr>
<tr>
<td>7/8”</td>
<td>.875”</td>
</tr>
</tbody>
</table>

For example:

#1. Record starting levels in all tanks and drums. Subtract the amount remaining.
#2. Record number of 5-gallon jugs used or reused. Add this to line #1 to calculate the total gallons of additive dispensed.
#3. Compare this to the amount of additive treated fuel dispensed. The ration should be 1/1000, or .1%.

Example with Numbers:

A. Total amount of treated fuel sold = 23,500 gallons.
B. Total amount of additive gone from inventory = 21.5 gallons.
C. 21.5 /23500 x 1000 = 0.915 % volume of additive to fuel. This is too low. It should be 0.1.

What could be wrong? The fueler forgot to turn on the injector, the reservoir went dry or the additive injector(s) is out of adjustment.

Remember: Additive = 1 gallon per thousand gallons
Continued Quick Guide to Additive Dispensed

<table>
<thead>
<tr>
<th>Rectangular metal tank: Record level in height of liquid from bottom of tank in inches with fractions in decimal form. Also record tank width and length (not height).</th>
<th>Horizontal Cylindrical tanks: Fill reservoir half way or specific gallons required.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A) Starting level _______”</td>
<td># of 5 gallon drums used ______ x 5 = _____ gallons additive</td>
</tr>
<tr>
<td>B) Ending Level _______”</td>
<td>B) Amount of additive removed from number of gallons of treated fuel sold _______ gallons.</td>
</tr>
<tr>
<td>C) Subtract B from A = _______”</td>
<td></td>
</tr>
<tr>
<td>D) Tank inside width (subtract a little for wall thickness) D _______”</td>
<td></td>
</tr>
<tr>
<td>E) Tank inside length (subtract a little for wall thickness) E _______”</td>
<td></td>
</tr>
<tr>
<td>F) Multiply D _______” x E _______” = F _______”</td>
<td></td>
</tr>
<tr>
<td>G) Divide F _______” / 231 = G _______” gallons per inch</td>
<td></td>
</tr>
<tr>
<td>H) C x G = Gallons dispensed</td>
<td></td>
</tr>
</tbody>
</table>

(A tank 12” x 16” is 192 cubic inches per inch of height. A gallon is 231 cubic inches. Such a tank is 192/231 = .83 gallons per inch. A change of 1.5 inches = 1-1/4 gallons.)

Conversion chart: Fractions to Decimal

<table>
<thead>
<tr>
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<th>Decimal</th>
</tr>
</thead>
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<tr>
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<tr>
<td>1/4”</td>
<td>.25”</td>
</tr>
<tr>
<td>3/8”</td>
<td>.375”</td>
</tr>
<tr>
<td>1/2”</td>
<td>.5”</td>
</tr>
<tr>
<td>5/8”</td>
<td>.625”</td>
</tr>
<tr>
<td>3/4”</td>
<td>.75”</td>
</tr>
<tr>
<td>7/8”</td>
<td>.875”</td>
</tr>
</tbody>
</table>

Remember: Additive = 1 gallon per thousand gallons
Recommended PPE for Dispensing Anti-Icing Additive Via an Aerosol Can

Neoprene or Rubber Gloves
Face Shield

Recommended PPE for Transferring Anti-Icing Additive From Bulb Storage Into a Dispenser

Goggles
Neoprene or Rubber Gloves
Splash Resistant

Half Mask Respirator with Organic Vapor Chemical Filters
There are several safety points to remember when refueling helicopters.

- Never walk behind a helicopter.
- Be aware of the tail rotor, and always stay within the pilot’s field of vision.
- When positioning your refueler, the vehicle must be outside the circle of blade rotation even if they are not moving.
- Helicopters develop large amounts of static electricity.
- Be sure the aircraft is securely bonded to the refueler prior to refueling. Allow the static to dissipate for several minutes prior to refueling.
- Keep helicopter landing areas clear and clean. Helicopter downwash will lift and move items into the air.
- Hold onto your hat, it can be drawn onto the rotor or engine intakes.
- Shield your eyes near a helicopter when it is landing or taking off.
- When directing a helicopter, stand with your back to the wind.
- Approach and leave the helicopter in a crouched manner.
- Hot, or rapid refueling, the terms used for refueling while the engine is running and the rotors are turning, is extremely dangerous and is not recommended.
- Always touch the refueling nozzle to the filler cap prior to opening the fuel tank.
<table>
<thead>
<tr>
<th>lb.</th>
<th>gal.</th>
<th>lb.</th>
<th>gal.</th>
<th>lb.</th>
<th>gal.</th>
<th>lb.</th>
<th>gal.</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>1</td>
<td>775</td>
<td>116</td>
<td>1625</td>
<td>243</td>
<td>2475</td>
<td>370</td>
</tr>
<tr>
<td>10</td>
<td>2</td>
<td>800</td>
<td>120</td>
<td>1650</td>
<td>247</td>
<td>2500</td>
<td>374</td>
</tr>
<tr>
<td>15</td>
<td>3</td>
<td>825</td>
<td>124</td>
<td>1675</td>
<td>250</td>
<td>2525</td>
<td>377</td>
</tr>
<tr>
<td>20</td>
<td>3</td>
<td>850</td>
<td>127</td>
<td>1700</td>
<td>254</td>
<td>2550</td>
<td>381</td>
</tr>
<tr>
<td>25</td>
<td>4</td>
<td>875</td>
<td>131</td>
<td>1725</td>
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An important component of many jet aircraft single point systems is the automatic fuel shutoff. This component is designed to terminate the flow of fuel into individual tanks or the entire aircraft when full. To ensure that the system is working properly, the system features a pre-check, which enables the refueling personnel to verify proper operation of the automatic shut-off during refueling operations.

Typically, the aircraft pre-check system is operated by a button or switch located on the aircraft fueling panel, or in some cases, near the single point access. To operate the pre-check, refueling must be underway and fuel must be flowing within the normal pressure range. The pre-check switch must be activated (and in some cases held “on”) until fuel stops flowing into the aircraft.

When the fuel stops flowing, this is verification that the automatic fuel shutoff system is operating properly. Releasing the switch (or returning it to the normal fueling position) will reactivate the flow of fuel into the aircraft.

For those aircraft equipped with pre-check systems, the approved procedures must be completed at the commencement of every single point refueling operation.
Since the basis of the single point refueling system is to deliver under pressure, the aircraft’s fuel vent system plays an important role in the operation of the aircraft’s fuel system. Essentially, the aircraft must be able to constantly vent the air that is displaced as the fuel enters the aircraft tank(s). This venting process is critical to ensure that over pressurization of the internal plumbing and tanks does not occur.

Typically, aircraft vents are located on the outboard, underside sections of the wings, near the wingtips.

When refueling certain business aircraft which utilize the single point system, you must always check the aircraft’s fuel vents immediately after commencement of refueling, to ensure that fuel system venting is occurring. Verification is easily accomplished by confirming that air is being released out of each aircraft fuel vent.

On some aircraft, prior to commencement of refueling operations, pressure within the fuel system must be released before refueling can be begun.

In addition, in the event that the fuel shutoff system has failed or if a shutoff valve has not closed properly, the fuel vents are also designed to route excess overboard and relieve pressure within the system once the tank(s) have reached their maximum capacity. Be prepared to shut off the flow of fuel immediately if fuel is pumped overboard. Each fuel spill, no matter how small, must be cleaned up in accordance with all local and federal guidelines. Personal protective equipment must also be utilized.
A. Definitions

Fuel Farm: A location, on or off airport property, where fuel intended for immediate or future distribution at the airport is stored.

B. Fuel Farm/Fuel Storage Facility Located Within the Air Operations Area

Each fuel farm located on the airport within the air operations area (AOA) can be designated a Security Identification Display Area (SIDA) so that they would conform to the requirements of 49 CFR §1542.205.

C. Fuel Farm/Fuel Storage Facility Located Outside the AOA

Each fuel farm/fuel storage facility located outside of the AOA or a secured area that is owned, managed, or otherwise directly controlled by the airport operator, can be identified as a SIDA that conforms to the requirements of 49 CFR §1542.205.

D. Fuel Vehicles Entering the SIDA or Secured Area

1) At vehicle access points that provide direct access to the SIDA or secured area, each time a vehicle engaged in or designed for the distribution of any type of flammable liquid fuel (such as aviation fuel or heating oil) enters the SIDA or secured area, the airport operator may consider the following:

a. Assurance that each vehicle possesses airport approved vehicle identification.

b. Inspection of vehicles in accordance with the procedures described in paragraphs i. through iv. below:

i. The airport operator may conduct a thorough visual inspection of the undercarriage of a vehicle, for example of areas in and behind the wheels using an inspection mirror or an equivalent. If there are any anomalies that would warrant further investigation of the vehicle, a TSA-certified explosives detection canine may be used, if available, to facilitate the search for potential explosives. If a suspected unauthorized explosive, IED, or LVIED is discovered on the vehicle, the responsible authority could contact an appropriate law enforcement authority or emergency services response authority to resolve the incident.

ii. The airport operator may consider opening and visually inspecting all interior and exterior compartments.

iii. The airport operator may inspect under the vehicle hood, as well as other protected areas.

iv. The airport operator may visually inspect the entire vehicle.

2) All fuel vehicles entering a SIDA or secured area from any form designated location may be inspected in accordance with the foregoing or other similar procedures.
E. Vehicle Operations and Passengers

At designated access points that provide access to the airport, the airport operator may verify the identity of all individuals in the vehicle.

F. Personnel Conducting Inspections: The airport operator may arrange that all individuals who conduct:

1) Identity verification and vehicle inspections have a means of communicating immediately with either the airport operator or appropriate law enforcement authority in the event of an emergency or breach of security.

2) Vehicle and vehicle occupant inspections receive appropriate training.
How to use a reclaim tank to improve your bottom line and protect the environment

What is a reclaim tank?
A reclaim tank is used to return useable fuel drained for QC inspection, back to storage for reuse. The tank is designed to allow waste (sediment and water) to settle out to and be drained away while the clean fuel is returned to storage.

What are the savings?
1. Sell/use fuel rather than pay to have it disposed as HazMat
2. Reduce cost for disposal of waste fuel (HazMat)
3. Eliminate risk and cost to store waste fuel on site
4. Reduce the reporting fees to the Department of Environmental Quality

Reclaim Tank Savings

<table>
<thead>
<tr>
<th></th>
<th>Sample A</th>
<th>Sample B</th>
<th>Sample B</th>
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<tbody>
<tr>
<td>Number of Fuel Tanks</td>
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<tr>
<td>Number of Fuel Trucks</td>
<td></td>
<td></td>
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<td>Total fuel sumped:</td>
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<td>per month</td>
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<td>per year</td>
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<td>Cost of Fuel with all taxes</td>
<td>$3.75</td>
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<td><strong>Fuel Cost Savings Per Year</strong></td>
<td>$27,000.00</td>
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<table>
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<th>Waste Fuel Disposal Cost</th>
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<tr>
<td>per Gal.</td>
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<tr>
<td>Savings per year</td>
<td>$14,400.00</td>
<td>$25,200.00</td>
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<td><strong>Total Savings per Year</strong></td>
<td>$41,400.00</td>
<td>$72,450.00</td>
<td>$93,150.00</td>
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How does the reclaim tank work?

If your storage tank has its own pump to unload a tanker, or to recirculate, the reclaim tank’s suction line would be connected to the suction side of the product pump. A check valve and ball valve would be installed in this line. This would allow the clean fuel to be drawn through the product pump and returned to storage.

The size of the reclaim tank should match the needs of your operation, and are available in 15, 30, or 50 gallon capacity. The reclaim tank would be anchored and bonded to the fuel system.

Installation and Operation Options

- Use a self contained hand or electric pump to return the fuel from the reclaim tank back to the storage tank.
- Install an in-line filter for fuel returned to the storage tank.
- Directly connect the filter and/or tank sumps to the reclaim tank
- Install a closed circuit sampler
- Install a waste receiving tank
SUPERVISOR MODULE INSTRUCTION PLAN - #1

MODULE: LINE SERVICE SUPERVISION & TRAINING MANAGEMENT

ONLINE TIME: 60 Minutes

CONCEPT: Seasoned line service specialists know and understand the technical aspects of the line job. Knowing how to supervise others and provide needed leadership is another story. Students will sharpen their supervisory, leadership and training skills with the training provided in this module.

MAJOR TOPICS:

1. Line service supervisor, leadership and trainer skills
2. Supervisor responsibilities
3. Supervising team logistics
4. Training, trainers and supervisors
5. Classroom training
6. Practical instruction
7. Training paperwork
8. Industry resources

LEARNING OBJECTIVES:

1. Sharpen supervisory skills
2. Sharpen leadership skills
3. Sharpen trainer skills
4. Improve the safety and quality of your operation
5. Improve the knowledge of your employees
6. Empower employees to do the right thing
7. Positively affect your operation and bottom line
8. Understand the role of the supervisor and trainer
9. Understand key advice to transition into a supervisor role
10. Understand that supervising requires good oversight
11. Understand supervising/training ensures all training is appropriate and includes best practices and procedures relevant to services provided
12. Understand supervising includes paperwork, equipment and personnel oversight
13. Understand supervising and team logistics
14. Understand supervisors are proactive
15. Understand supervisors plan ahead
16. Become familiar with training objectives that result
in better quality and productivity, increased customer satisfaction, improved safety and reduction in accidents.

(17) Understand supervising and motivating multi-generational teams
(18) Understand supervising leads to potential aviation career advancement opportunities
(19) Understand the impact supervising has on company culture
(20) Understand supervisor qualities that make a difference
(21) Understand communication is key to supervising and training
(22) Understand verbal and non-verbal communication skills
(23) Understand the dynamics of combining training methods to increase learning retention
(24) Become familiar with the resources and documents to assist with training
(25) Become familiar with key areas of site specific training
(26) Understand the importance of training paperwork

TRAINING AIDS/MATERIALS:

(1) Supervisory Online Module #1: Line Service Supervision And Training Management
(2) Supervisory Online Line Service Supervision And Training Management Manual
(3) Company Standard Operating Procedures

REFERENCED PUBLICATIONS:

(1) Supervisory Online Line Service Supervision And Training Management Manual
(2) NATA Safety 1st eToolkit article on Why Generation Y – Retaining Frontline Employees
SUPERVISOR MODULE INSTRUCTION PLAN - #1

INSTRUCTION TIME:

- Classroom: 3-5 hours
- Preview of material: 15 min
- Online viewing: 60 min

Review and discussion: 2-4 hrs
- Line service supervisor, leadership and trainer skills
- Supervisor responsibilities
- Supervising team logistics
- Training, trainers and supervisors
- Classroom training
- Practical instruction
- Training paperwork
- Industry resources

OJT: 2-4 hrs
- Observe and demonstrate supervisor skills with mentor
- Observe and demonstrate trainer techniques with mentor
MODULE: GENERAL FUEL SERVICING

ONLINE TIME: 55 Minutes

CONCEPT: Assuring that the correct type, grade and amount of fuel has been uplifted into an aircraft is critical to the safety of those aboard that aircraft. Employees must be shown the proper refueling procedures and taught to exercise safe work habits for each and every aircraft refueling in order to prevent tragic accidents.

MAJOR TOPICS: (1) Fuel products (2) Fuel additives (3) Aircraft types (4) Refueling methods and equipment (5) General refueling practices (6) The refueling process (7) Refueling details

LEARNING OBJECTIVES: (1) To be able to explain the proper procedure to follow when any doubts or questions arise prior to or during any refueling operation (2) To be able to correctly identify fuel using color, odor and feel (3) To be able to identify the proper fuel type required for reciprocating (piston) engine, turboprop and jet engines (4) To be able to understand and explain the approximate weight of jet fuel and how to convert into pounds from gallons (5) To be able to explain the function of jet fuel additives and to demonstrate the proper technique for adding additives during refueling (6) To be able to distinguish the difference between reciprocating (piston) engines, turboprop and jet engines and describe the oils required by each as well as the safety precautions for servicing (7) To be able to understand and explain the basic operation of a reciprocating (piston) engine, turboprop engine and jet engine aircraft including
“turbofans”

(8) To be able to understand and explain the operational differences between a “turbocharger” and a “turboprop”

(9) To be able to identify reciprocating, turboprop and jet engine aircraft normally found on the FBO ramp and to perform the proper refueling of each of these aircraft

(10) To be able to correctly identify avgas and jet refuelers and fuel storage systems using color coded and DOT placards of refueling equipment and refueler

(11) To become familiar and be able to demonstrate the proper refueler “pre-check”

(12) To be able to explain and complete general refueling paperwork neatly and accurately

(13) To be able to recognize and become familiar with the proper operation of the three common types of reciprocating engine aircraft fuel caps

(14) To become familiar with the hazards associated and the precautions required for the refueling of helicopters

(15) To be able to explain and demonstrate the proper operating procedures for single point refuel nozzles and “deadman controls”

(16) To become familiar with the term “balanced fuel loading” and understand the precautions to take for servicing turbine aircraft

(17) To be able to understand and explain the basic operation of an APU

(18) To be able to explain and demonstrate the proper safety procedures to follow when working in the vicinity of any operating APU

TRAINING AIDS/MATERIALS:

(1) Supervisory Online module #2: General Fuel Servicing

(2) Supervisory General Fuel Servicing reference materials

(3) Aircraft Ground Service Online (AGSO)

(4) Company Standard Operating Procedures
MODULE INSTRUCTION PLAN - MODULE #2

(5) Company Emergency Procedures manual
(6) Applicable fuel spill and reporting procedures
(7) Company Material Safety Data Sheets manual
(8) Company fire and safety policies and procedures
(9) Mobile and fixed refueler operating manual(s)
(10) Fuel storage system operating procedures
(11) Airport rules and regulations manual

REFERENCED PUBLICATIONS:

(1) Advisory Circulars -
http://www.faa.gov/regulations_policies/advisory_circulars/
AC 00-34A – Aircraft Ground Handling and Servicing
AC 91-13C – Cold Weather Operation of Aircraft
AC 150/5230-4B – Aircraft Fuel Storage, Handling and Dispensing on Airports

(2) Airport Ground Vehicle Operations FAA Guide
http://www.spokaneairports.net/RFP/airport_grounded_vehicle_guide.pdf

(3) EI (API) 1542 - Identification Markings for Dedicated Aviation Fuel Manufacturing and Distribution Facilities, Airport Storage and Mobile Fuelling Equipment
http://www.energyinst.org/information-centre/ei-publications/newpubs/EI-1542

(4) NFPA 407 – Aircraft Fuel Servicing
www.nfpa.org

INSTRUCTION TIME:

Classroom: 6 - 8 hours
Preview of material: 15 min
Online viewing: 55 min
Review and discussion of: 2 - 3 hr
• Reciprocating (piston), turboprop and jet engine fuel and oil products
• Avgas and jet refuelers and refuel systems
• Refueling paperwork
• General reciprocating, turboprop and jet engine aircraft servicing procedures and precautions
• Multi-engine reciprocating engine aircraft aircraft servicing procedures
MODULE INSTRUCTION PLAN - MODULE #2

- General reciprocating, turboprop and jet engine aircraft review
- General reciprocating and turbine engine helicopter servicing procedures and precautions

**OJT:** 8 - 10 hours

**Hands-on** review:
- Avgas and jet fuel storage system
- Avgas and jet refueling equipment (mobile/fixed)
- Driving and operation of avgas and jet refuelers
- Reciprocating, turboprop and jet engine aircraft
- Reciprocating engine fuel caps
- Reciprocating, turboprop and jet engine aircraft refueling and oil servicing procedures
- Reciprocating and turbine engine helicopter refueling and servicing procedures
- Jet aircraft over wing refueling and servicing procedures
- Jet aircraft single point refueling and servicing procedures
MODULE: FUEL FARM MANAGEMENT

ONLINE TIME: 55 Minutes

CONCEPT: Assuring that all fuel received, stored, and delivered into aircraft is both clean and dry requires a high degree of care and responsibility. Delivering the incorrect type of fuel, or fuel that is contaminated, will almost certainly result in aircraft damage, loss of life or both! The importance of delivering good, clean product cannot be over emphasized.

MAJOR TOPICS:

1. Quality control, contaminants and checks at fuel farm
2. Fuel storage activities, safety and security
3. Fuel farm monitoring and testing
4. Fuel ordering, receiving and loading
5. Refueler monitoring and testing

LEARNING OBJECTIVES:

1. To understand that it is every person’s responsibility to ensure the fuel being delivered into aircraft is of the correct type and grade and meets the highest standards for quality control
2. To become familiar and be able to define, identify, and explain the source, effect, prevention and removal of the following more common aviation fuel contaminants;
   a) free water
   b) solids
   c) microorganisms
   d) surfactants
   e) inadvertent mixing of fuels
3. To be able to explain and correctly identify all tanks, pipelines, filter vessels and fittings using industry standard color coding, banding, arrows and lettering
4. To become familiar and understand fuel filtering systems, components and processes
5. To become familiar and understand the correct operation of your fuel storage system including the type of storage tank system, emergency shut off
controls and fire extinguishers

(6) To understand and explain the procedures and importance of maintaining a clean and secure fuel storage facility

(7) To understand and be able to explain the proper safety equipment, procedures and placards required at, on and near fuel storage areas, loading islands and refuelers

(8) To be able to understand, explain and perform the proper procedures for the following fuel quality tests and checks;
   a) Clear and Bright test
   b) White Bucket test
   c) Sump sample check
   d) Water finding paste test
   e) Millipore test
   f) Differential Pressure check

(9) To become familiar with the proper procedures and actions required following operation of the differential pressure gauge

(10) To understand the criteria for filter coalescer element replacement

(11) To understand and be able to explain the DAILY quality control checks that must be made and recorded as follows;
   a) Sump each storage tank
   b) Water detection for each storage tank
   c) Sump each filter vessel
   d) Differential pressure gauge reading
   e) Record the fuel quantity in each storage tank
   f) Tank vents - clear and open
   g) Tank hatches - secure
   h) Bonding wires - continuity and operation
   i) Hoses and connections - damage and/or leaks
   j) Nozzle dust covers - in place
   k) Pumps and motors - rotation and operation; seals and gaskets - leaks
   l) Storage area - clean and free of weeds
   m) Fire extinguishers - broken seals, plugged/damaged discharge nozzles,
recharge inspection dates

(12) To understand and be able to explain the WEEKLY quality control checks that must be made and recorded as follows;
   a) Deadman controls and emergency shut off devices - proper operation
   b) Floating suction - freedom of movement
   c) Signage/placards - in place, secure, easily readable

(13) To understand and be able to explain the MONTHLY quality control checks that must be made and recorded as follows;
   a) Filter Millipore/Membrane
   b) Loading hoses working pressure - separations, soft spots and deterioration
   c) Oil level/lubrication of pumps, hose reels, motors and other equipment requiring lubrication
   d) Automatic water slug shutoff valve - proper operation

(14) To understand and explain the procedures to follow for monthly fuel inventory

(15) To understand and be able to explain the other “PERIODIC” quality control checks that must be made and recorded as follows;
   a) Fuel sump heaters (quarterly) - proper operation
   b) Tank visual inspection for corrosion, scale or possible rupture (1st year (new)/then inspect subsequently at periods not exceeding 3 years) – clean tanks if contaminants found

(16) To become familiar with the general procedures and safety concerns for ordering and accepting bulk fuel shipments including the following specific control checks to determine acceptability;
   a) Appearance - clear and bright and fuel color
   b) Water detection test
   c) Gravity check

(17) To understand the proper procedures to follow for monitoring and testing of refuelers including;
   a) general appearance and cleanliness
b) placarding and identification

c) proper equipment and maintenance

d) daily checks

e) weekly checks

(18) To understand the proper procedures to follow for refueler loading

TRAINING AIDS/MATERIALS:

(1) Supervisory Online Module 3: Fuel Farm Management

(2) Supervisory Fuel Farm Management reference materials

(3) Company Fuel Storage Operating Procedures

(4) Pictures/diagrams/schematic of your fuel storage system and piping layout

(5) Fuel sampling equipment

(6) Fuel Supplier Fuel Quality Control Manual

(7) Company Standard Operating Procedures

(8) Company fire and safety policies and procedures

(9) Company Emergency Procedures manual

(10) Airport rules and regulations manual

(11) Company Material Safety Data Sheets manual

(12) Applicable fuel spill/reporting procedures

REFERENCED PUBLICATIONS:

(1) Advisory Circulars -
http://www.faa.gov/regulations_policies/advisory_circulars/
AC 00-34A – Aircraft Ground Handling and Servicing
AC 150/5230-4B – Aircraft Fuel Storage, Handling and Dispensing on Airports

http://www.astm.org/BOOKSTORE/PUBS/MNL5-4TH.htm

(3) EI (API) 1542 - Identification Markings for Dedicated Aviation Fuel Manufacturing and Distribution Facilities, Airport Storage and Mobile Fuelling Equipment
http://www.energyinst.org/information-centre/ei-publications/newpubs/EI-1542

(4) NFPA 407 – Aircraft Fuel Servicing
www.nfpa.org
INSTRUCTION TIME:  

Classroom: 3 - 4 hours  
Preview of material: :15 min  
Online viewing: :55 min  
Review and discussion: 1 - 2 hr  

- Fuel storage system and equipment  
- Specific fuel quality control procedures  
- General fuel receiving and loading procedures and precautions  
- Specific scheduled checks  
  - Daily  
  - Weekly  
  - Monthly  
  - Periodic

OJT: 4 - 5 hours  

Hands-on review:  
- Fuel storage system placarding, fuel quality systems and safety and equipment  
- Fuel quality control checks;  
  - Daily  
  - Weekly  
  - Monthly  
  - Periodic  
  - Filter coalescer element replacement  
  - Differential pressure gauge operations  
- Hands-on review of the various fuel contaminants  
- Refueler fuel quality systems and equipment  
- Refueler fuel quality control checks as listed above and including;  
  - Daily checks  
  - Weekly checks  
  - Monthly checks  
  - General appearance and cleanliness  
  - Placarding and identification  
  - Proper equipment and maintenance  
- Fuel inventory procedures  
- Ordering and accepting bulk fuel shipments  
- Refueler bottom loading procedures  
- Typical operations and procedures
SUPERVISOR MODULE INSTRUCTION PLAN - #4

MODULE: REFUELER SAFETY

ONLINE TIME: 60 Minutes

CONCEPT: One of the most critical aspects of a professional line service specialist is refueling safety. Refueling safety is much more than just protecting you and your coworkers. It is also about protecting aircraft and the passengers and crew they carry.

MAJOR TOPICS:

(1) Misfueling overview
(2) Refueling safety
(3) Aircraft engines and fuel requirements
(4) Misfueling prevention
(5) Other refueling hazards
(6) Mobile refueler facts
(7) Operating a mobile refueler
(8) Safe operating of mobile refuelers

LEARNING OBJECTIVES:

(1) Understand and explain the consequences and precautions for prevention of a misfueling
(2) To be able to differentiate between piston, turboprop and jet aircraft
(3) To understand, explain the two refueling methods and identify the different refueling nozzles
(4) Know and understand the aircraft fuel order form
(5) Know and understand aircraft grade wing decals
(6) Know and understand fuel load and distribution for different aircraft
(7) Understand and explain the procedures for preventing fuel contamination
(8) Understand and explain fuel spill safety procedures
(9) Understand and explain the procedures for preventing fuel contamination
(10) Understand and explain the purpose, operation and location of the safety equipment, operating components and servicing supplies found on refuelers
(11) Explain and demonstrate the procedure for performing a visual check on mobile refuelers prior to refueling operations

(12) Know and explain characteristics of mobile refuelers

(13) To be able to explain, and demonstrate the correct operation of deadman and emergency shutoff controls

(14) Know and explain the general procedures for driving a mobile refueler on the ramp

TRAINING AIDS/MATERIALS:

(1) Supervisory Online Module 4: Refueler Safety
(2) Company Standard Operating Procedures
(3) Company Emergency Procedures manual
(4) Company fire and safety policies and procedures
(5) Company Material Safety Data Sheets manual
(6) Applicable fuel spill/reporting procedures

REFERENCED PUBLICATIONS:

(1) Supervisory Online Module #4: Refueler Safety
(2) Supervisory Online Line Service Supervision And Training Management Manual
(3) Advisory Circulars - http://www.faa.gov/regulations_policies/advisory_circulars/
   AC 00-34A – Aircraft Ground Handling and Servicing
   AC 20-35C – Tie-down Sense
   AC 20-122A – Anti-misfueling Devices: Their Availability and Use
   AC 91-13C – Cold Weather Operation of Aircraft
   AC 150/5230-4B – Aircraft Fuel Storage, Handling and Dispensing on Airports
   AC 150/5230-20 - Ground Vehicle Operations on Airports
(4) Company Standard Operating Procedures
INSTRUCTION TIME:

**Classroom:** 1-2 hours
- Preview of material: 15 min
- Online viewing: 60 min

**Review and discussion:** 1-3 hrs
- Refueling and misfueling discussion
- Refueler driving procedures

**OJT:** 1-3 hrs
- Refueling and misfueling discussion
- Refueler driving procedures
- Refueler parking procedures
- Refueler checks and procedures
SUPERVISOR MODULE INSTRUCTION PLAN - #5

MODULE: PERSONAL PROTECTIVE EQUIPMENT

ONLINE TIME: 30 Minutes

CONCEPT: Personal protective equipment, PPE, puts a barrier between workers and danger. OSHA developed the PPE standard, CFR 1910.132 that requires employers to establish and administer an effective PPE program to protect employees in the workplace. This module will give you an understanding of PPE and your responsibilities to ensure workers’ safety.

MAJOR TOPICS:
(1) Why PPE is important
(2) Types of PPE
(3) How to assess the need for PPE
(4) How to wear, remove and maintain PPE

LEARNING OBJECTIVES:
(1) Understand what personal protective equipment (PPE) is
(2) Understand the purpose of PPE
(3) Understand the many types of PPE
(4) Understand how to assess the need for PPE
(5) Understand the criteria for selecting PPE
(6) Understand the hierarchy of controls to protect employees
(7) Understand that all PPE used must be correct for the job being conducted and maintained properly
(8) Understand the limitations of PPE
(9) Understand the proper care, maintenance, useful life and disposal of PPE
(10) Understand the steps to properly don, doff, adjust and wear PPE

TRAINING AIDS/MATERIALS:
(1) Supervisory Online Module #5: Personal Protective Equipment
(2) Supervisory Online Line Service Supervision And Training Management Manual
(3) Company Standard Operating Procedures
REFERENCED PUBLICATIONS:

(1) Supervisory Online Line Service Supervision And Training Management Manual
(2) OSHA CFR 1910.132

INSTRUCTION TIME:

Classroom: 2-3 hours

Preview of material: 15 min
Online viewing: 30min

Review and discussion: 1-2 hrs

- Why PPE is important
- Types of PPE
- How to assess the need for PPE
- How to wear, remove and maintain PPE

OJT: 1-2 hours

- Why PPE is important
- Types of PPE used at your operation
- PPE and its limitations
- How to inspect PPE for proper fit
- How to don PPE
- How to doff PPE
- How to adjust PPE
- How to care for PPE
- Company contact for PPE questions and equipment
SUPERVISOR MODULE INSTRUCTION PLAN - #6

MODULE:  
HAZARD COMMUNICATION

ONLINE TIME:  30 Minutes

CONCEPT:  
The workplace can contain hazardous chemicals that can harm your employees if they are exposed to dangerous levels. OSHA requires employers to protect employees by providing clear information about all the chemicals at your operation and ensure that employees are trained on how to protect themselves from the effects of these hazardous chemicals.

MAJOR TOPICS:
(1) Hazardous chemical environment
(2) Types of chemicals
(3) Labels and warning signs
(4) Material safety data sheets

LEARNING OBJECTIVES:
(1) Understand and be aware that you are exposed to hazardous chemicals
(2) Understand the risks of exposure to chemicals and the harm that can be done
(3) Understand how to assess and protect all employees from hazardous chemicals
(4) Understand and know how to read and use labels and material safety data sheets to ensure the safety of all employees
(5) Understand and know how hazardous chemical information can be obtained and used at your operation
(6) Understand the importance of following your hazardous chemical (hazcom) protective measures
(7) Understand your company’s responsibility to tell all employees about the hazardous chemicals at your operation
(8) Understand your company’s responsibility to train all employees how to protect themselves from the effects of hazardous chemicals at your operation
(9) Understand chemical exposure and threshold limits
(10) Understand how chemicals can enter the body and how best to protect employees
(11) Know and understand the different forms that
(12) Understand and train others on reporting procedures for hazardous exposures

(13) Understand your responsibilities on material safety data sheets (MSDS) to your employees

TRAINING AIDS/MATERIALS:  
(1) Supervisory Online Module #6: Hazard Communication
(2) Supervisory Online Line Service Supervision And Training Management Manual
(3) Company Standard Operating Procedures

REFERENCED PUBLICATIONS:  
(1) Supervisory Online Line Service Supervision And Training Management Manual
(2) OSHA CFR 1910.1200
http://www.osha.gov/dsg/hazcom/index.html

INSTRUCTION TIME:  
Classroom: 1-3 hours
Preview of material: 15 min
Online viewing: 30 min

Review and discussion: 1-2 hrs
→ Hazardous chemicals environment and handling
→ Types of chemicals, including containment
→ Labels and warning signs
→ Material safety data sheets

OJT: 2-3 hours
→ Discuss hazardous chemicals at your operation
→ Discuss handling and containment of hazardous chemicals
→ Discuss types of chemicals and appropriate PPE
→ Review labeling and warning signs
→ Review and discuss material safety data sheet (MSDS)
→ Discuss company location and update responsibilities for MSDS
→ Discuss first aid measures and treatments at your company
SUPERVISOR MODULE INSTRUCTION PLAN - #7

MODULE:        FIRE PREVENTION AND EVACUATION

ONLINE TIME:   30 Minutes

CONCEPT:       It’s everyone’s responsibility to look for fire hazards, practice fire prevention and know what to do in a fire.

MAJOR TOPICS:
(1) Preventing fires
(2) Exits and egress
(3) Evacuation plan
(4) Fire evacuation
(5) Fighting the fire

LEARNING OBJECTIVES:
(1) Understand and identify fire hazards in the workplace
(2) Understand and explain the importance of keeping exits unlocked and clear of obstructions
(3) Understand reasons for fire and smoke doors
(4) Understand that fumes and smoke can travel up to 300 feet per minute
(5) Explain the importance of knowing the location of exits, alarm pulls and fire extinguishers
(6) Understand and know company evacuation plan
(7) Know the nearest fire exit throughout your company
(8) Understand and participate in fire evacuation drills
(9) Understand and know how to assist others in the event of a fire
(10) Understand and know what to do if others require special assistance
(11) Know how to contact assistance in the event of fire
(12) Understand and list actions to take in the event of a fire
(13) Understand and know about your emergency meeting location
(14) Understand and know how to extinguish a fire
(15) Identify considerations before attempting to fight a fire
SUPERVISOR MODULE INSTRUCTION PLAN - #7

TRAINING AIDS/MATERIALS:

(1) Supervisory Online Module #7: Fire Prevention And Evacuation
(2) Company Evacuation Plan
(3) Company Emergency Contact Information
(4) Company Standard Operating Procedures

REFERENCED PUBLICATIONS:

(1) Supervisory Online Line Service Supervision And Training Management Manual
(2) OSHA CFR 1910.39

INSTRUCTION TIME:

Classroom:  2-4 hours
Preview of material:  15 min
Online viewing:  30 min
Review and discussion:  2-3 hrs

- Preventing fires
- Exits and egress
- Evacuation plan
- Fire evacuation
- Fighting the fire

OJT:  2-3 hours

- How to identify fire hazards
- How to keep exits unlocked and clear of obstructions
- Know importance and location of fire and smoke doors
- Know location of exits, alarm pulls and fire extinguishers
- Understand and know company evacuation plan
- Understand fire evacuation drill procedures
- How to contact assistance in the event of fire
- Know what actions to take in the event of a fire
- Know and understand emergency meeting location
- Know how to extinguish a fire (PASS)
- Understand considerations before attempting to fight a fire
MODULE: FIRE SAFETY

ONLINE TIME: 90 Minutes

CONCEPT: Fire Safety as it relates to fuel handling is a major safety concern when considering the volatility of fuel and the volumes which are transferred during all fueling, loading and unloading operations. Lives are at stake when proper procedures are not followed. The handling and storage of aviation fuel cannot be taken lightly nor should it be conducted without proper introductory and recurrency training. Establishing and maintaining procedures for the protection of persons, aircraft and other property during the handling and storing of aviation fuel is required.

MAJOR TOPICS:

(1) Fire Safety Standards and Characteristics of Aviation Fuels
(2) Recognizing Fires and Extinguishing Agents
(3) Fighting Fires
(4) Minimizing Fire Risk

LEARNING OBJECTIVES:

(1) To understand and explain the requirements for 14 CFR Part 139 Section 321 as it applies to fuel handling
(2) To understand the fire hazard properties and characteristics of aviation fuels
(3) To understand the four (4) elements necessary to cause and support a fire as presented in the fire tetrahedron
(4) To understand the extinguishing of a fire is accomplished through the interruption of one or more of the essential elements as presented in the fire tetrahedron
(5) To be able to explain the four (4) different classifications of fires
(6) To be able to define and explain the extinguishing agents, their applicability to the four (4) different classes of fires and the characteristics of each extinguishing agent
(7) To be able to explain and demonstrate the step-by-step
procedures and techniques for using fire extinguishers

(8) To be able to explain the size, type and number of fire extinguishers required on mobile refuelers, fixed refueling systems and at fuel storage systems

(9) To be able to explain and correctly identify all mobile refuelers, hydrant carts, fueling cabinets fuel storage tanks, pipelines, filter vessels and fittings using industry and government standard color coding, banding, arrows and lettering

(10) To understand the safety equipment required on mobile refuelers and other refueling equipment including:

- emergency shut-off controls
- deadman controls
- baffled muffler and exhaust systems
- air filer/flame arrestor equipment
- removal of smoking equipment from refuelers
- shielding to safely drain potential fuel spills away from potential ignition sources

(11) To be able to explain the dangers of static electricity and the precautionary safety procedures to follow to prevent static discharge including:

- proper clothing for refueling personnel
- handling and use of plastic, galvanized and non-galvanized funnels and buckets
- handling of lighters and matches by refueling personnel
- operation of refueling safety equipment
- operation of radios, vehicle engines, GPU’s, electrical equipment and aircraft radar

(12) To understand and explain the proper bonding concerns and procedures to follow for all refueling operations

(13) To understand and be able to explain the procedures for responding to and handling of a fuel spill or leak and the hazards presented to personnel with clothing contaminated by spilled fuel

(14) To understand and be able to explain the proper safety and security equipment, procedures and placards required at, on and near all fuel storage systems, loading islands and refuelers
(15) To be able to understand and explain the proper procedures to follow for aircraft refueling operations including:

- refueling downstream of jet and turboprop engine exhausts
- thunderstorms and refueling operations including the calculation process to determine the distance from thunderstorms
- jet engine intakes
- loose items and objects carried by personnel

(16) To understand the proper safety procedures to follow for public protection including:

- refueling aircraft with passengers on board
- aircraft refueling operations within fifty (50) feet of passenger vehicles
- display of NO SMOKING signs at ramp entrances
- proper bonding procedures

TRAINING AIDS/MATERIALS:

1. PLST Online Module 7: Fire Safety
2. PLST Fire Safety reference materials
3. Company Fuel Storage Operating Procedures
4. Pictures/diagrams/schematic of your fuel storage system and piping layout
5. Refueling equipment (mobile refuelers/hydrant carts/cabinets)
7. Company Standard Operating Procedures
8. Company fire and safety policies and procedures
10. Local Fire codes and regulations as it pertains to your local airport
11. Airport rules and regulations manual
12. Samples of the fire extinguishers used at your facility

REFERENCED PUBLICATIONS:

   AC 00-34A – Aircraft Ground Handling and Servicing
   AC 150/5230-4B – Aircraft Fuel Storage, Handling and...
Dispensing on Airports

(2) EI (API) 1542 - Identification Markings for Dedicated Aviation Fuel Manufacturing and Distribution Facilities, Airport Storage and Mobile Fuelling Equipment
http://www.energyinst.org/information-centre/ei-publications/newpubs/EI-1542

(3) NFPA 407 – Aircraft Fuel Servicing
www.nfpa.org

INSTRUCTION TIME:

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- Fire hazard characteristics;
  - flash point
  - flammability conditions
  - autoignition temperature
  - heat of combustion
  - rate of flame spread
- Fire tetrahedron
- Fire extinguisher operating principles
- Fire extinguishing types, agents and applicability
- Fire extinguisher procedures (PASS)
- Fuel placarding and identification
- Mobile refuelers and safety equipment
- Fuel storage safety and security
- Aircraft refueling safety
- Static electricity
- Bonding
- Fuel spill response and handling
- Public and personal safety concerns
**OJT:**  
4 - 5 hours  

Hands-on review:  
- Fire extinguisher types and locations on each mobile refueler and in all buildings, hangars, ramps, fuel storage areas, etc.  
- Fire (live if possible) demonstration with hands-on review and employee practice of the proper procedures for extinguishing a fire  
- Fuel storage system operations, fire safety concerns and safety equipment  
- Refueling system operations (mobile and fixed), fire safety concerns and safety equipment  
- Fuel spill materials, storage locations(s) and approved disposal
Training Records
Hands-on Fire Extinguisher Training Record

Student Information:

Name: _____________________________________________________________________

Company: __________________________________________________________________

Address: ___________________________________________________________________

City: __________________________ State: ________ Zip: ________________________

Completion of this form verifies that: (Student Name)______________________________has received hands-on training in the use of a portable fire extinguisher.

The training was completed on: ______/_____/______

Trained by:

Name: _____________________________________________________________________

Position: __________________________________________________________________

Company Name: ___________________________________________________________

Signature: __________________________________________________________________

This completed form should be filed within the student’s training record.
**LINE SERVICE SPECIALIST TRAINING RECORD**

| Employee___________________________________  |
| Address____________________________________  |
| Date of Employment___________Employee No.____  |
| Supervisor__________________________________  |

**Trainer/Supervisor: Date and initial each category as training progresses.**

### Familiarization with Company/Organization

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**Familiarization with Emergency Procedures**

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**Familiarization with Aviation**

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**Introduction to Quality Control**

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### Safety

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Enter the ending date for each of the next 26 weeks and continue entering for weeks 27-52 on the next page. Use the symbols below for training.

- **I** = Initial Training
- **Q** = Qualification Date
- **D** = Demonstration by Employee
- **F** = Follow-up Training
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Fire Safety Guide

7.1 Introduction to Fire Safety
This module of the professional line service training program deals exclusively with the subject of fire and fulfills the fire safety training required by Title 14 of the Code of Federal Regulations, commonly referred to as 14 CFR, Part 139 Section 321.

During this training, you will:

- Be introduced to regulatory and training requirements for personnel handling fuel products
- Learn to identify properties of aviation fuel that contribute to a fire hazard
- Examine the fire tetrahedron to understand why fires occur and how they behave under different conditions
- Learn the appropriate types of extinguishing agents and equipment for fighting different classes of fires
- Gain valuable perspective on your role in fighting fires
- Examine the steps you can take to prevent fires from occurring

7.2 Training and Certification
The training in this module is designed to enable fuel service providers, airports and air carrier fueling operations at certificated airports to meet the requirements of Title 14 of the Code of Federal Regulations, Part 139 Section 321.

Adoption of these guidelines for non-certificated airport operators will significantly increase fuel handling safety and should be implemented as a best practice.

We will begin with an Introduction to Fire Safety. After reading this introductory topic, you will be able to identify characteristics of aviation fuel that contribute to a fire hazard.

Your airport has established fire safety standards and procedures for equipment and installations. These standards apply to the protection of people, aircraft and other property during refueling operations and other airport activities.

In addition, airports that hold a Part 139 certificate, or Airport Operating Certificate, must comply with the requirements of 14 CFR Part 139 Section 321 and are required to establish and maintain standards to protect against fire and explosion in storing, dispensing and handling fuel.
This includes airports that serve scheduled and non-scheduled air carrier operations with more than 30 passenger seats, airports that serve scheduled air carrier operations with more than 9 but less than 31 passenger seats and any airport that the Federal Aviation Administration requires an Airport Operating Certificate or 139 certificate.

Each fueling company on the airport must have at least one supervisor trained, through an approved aviation fuel training course in fire safety, like this one, that is authorized by the Administrator every 24 consecutive calendar months.

This supervisor is authorized to provide on the job training to all employees of the company that handle aviation fuel. This training is required to be conducted every 24 consecutive calendar months. Permanent records of such training must be maintained in the employee’s personnel file.

The FAA recognizes the potential hazards that accompany fueling operations and, as such, has outlined standards for fire safety facilities, procedures and training. In particular, 14CFR 139.321 must include bonding, public protection, control of access to storage areas, fire safety in fuel farm and storage areas, fire safety in mobile refuelers, fueling pits and fueling cabinets, fire safety training for all personnel and a briefing of the local fire code from the public body having jurisdiction over the airport.

Considering the emphasis placed on standards for fire safety facilities, procedures and training, it is appropriate that we begin our fire safety discussion with aviation fuel and fire safety.

You will primarily be dealing with two types of fuel at your airport; avgas and jet fuel. These two fuels vary considerably in composition, and possess unique fire hazard properties.
7.3 Characteristics of Aviation Fuels

In order to understand these properties, we need to look at several characteristics that define the potential fire hazard.

These are:
- Flash Point
- Flammability Range
- Autoignition Temperature
- Heat of Combustion
- Rate of Flame Spread

7.3.1 Flash Point

Flash Point is the lowest temperature at which a liquid fuel gives off sufficient vapors to form an ignitable mixture of fuel and air.

If an ignition source is present and the fuel is at or above flash point, the vapor can ignite.

- Avgas has a flash point of approximately minus 50° Fahrenheit or minus 46° Celsius.
- Jet A has a flash point of approximately 100° Fahrenheit or 38° Celsius.

You must use caution and ensure that fuel vapors do not come into contact with potential sources of ignition.
7.3.2 Flammability Range

The Flammability of aviation fuel is a measure of the percentage range of fuel vapor in the air that will allow ignition to take place. When both fuel and oxygen are present, a key factor in determining the potential flammability of the fuel is the mixture, or ratio of fuel to oxygen.

If the percentage of the fuel in the air is below the lower limit, the mixture is too lean and ignition can not occur. Similarly, if the percentage of the fuel in the air is above the upper limit, the mixture is too rich to allow ignition to occur.

Be aware that during many refueling operations, the vapors in the air can be within the flammability range. Always exercise extreme caution during refueling.

7.3.3 Autoignition

Autoignition is the temperature at which fuel will automatically ignite without a spark or outside ignition source.

- The Autoignition temperature for most avgas is 840° Fahrenheit or 449° Celsius.
- Jet A auto-ignites at 475° Fahrenheit or 246° Celsius.

There are a number of components on or near an aircraft that can generate temperatures high enough for autoignition to occur. It is important to ensure that fuel or fuel vapors cannot touch any surface or device that is at or near the autoignition temperature of the fuel.

The residual heat present in engines and brakes can cause spilled or sprayed fuel to ignite if they have not cooled below the autoignition temperature. The visual appearance of aircraft components is seldom a good indicator of temperature therefore; consider all surfaces to be above the auto-ignition point. Even when the temperature has dropped below the autoignition level, the engines and brakes may still be hot enough to vaporize spilled fuel.

All ignition sources, such as static electricity, become extremely hazardous in the presence of flammable vapors. Vehicle components, such as exhaust pipes and manifolds are potential sources for autoignition of aviation fuels.

Leaking or spilled fuel in the presence of hot engine components can ignite. Similarly, uncovered or broken lights and light fixtures create an autoignition risk.

Therefore, it is important to ensure that fuel or fuel vapor do not come into contact with any surface that is at or near the autoignition temperature of that fuel.

7.3.4 Heat of Combustion

The heat generated from the combustion of fuel (Heat of Combustion) is an important consideration when preparing to fight a fire.
Heat is measured in **British Thermal Units**, or BTUs, where one BTU is the amount of heat required to raise the temperature of one pound of water one degree Fahrenheit.

Avgas produces approximately 19000 BTUs of heat energy, while jet fuel produces slightly less.

### 7.3.5 Rate of Flame Spread

**Rate of flame spread** is the speed at which a flame travels across the surface of a body of fuel.

Avgas has a rate of flame spread that is 30 times that of Jet A. This is an important factor to consider when evaluating the severity and potential fire hazard of a fuel spill. More importantly it is a factor that can affect your ability to fight or control a fire. Simply put, an avgas fuel spill, once ignited, can turn into a raging inferno in an instant.

The slower rate of flame spread of Jet A applies to jet fuel in its liquid form. Jet A and avgas essentially have identical rates of flame spread when they are atomized and released as a mist, or have been heated to a temperature at or above their flash point.

All aviation fuels, regardless of type or grade, pose a serious fire risk. You can lessen that risk by knowing the characteristics of fuel.

The characteristics of aviation fuels discussed in this topic are very important in helping you recognize fire hazard properties and will help you determine the best course of action to take if a fire happens.

### 7.4 Understanding Fires

A key component of Fire Safety is a fundamental knowledge of fire itself, and the agents available for fighting it. In this topic, you will examine the elements required to sustain a fire and the extinguishing agents used to fight fires.

After reading this topic, you will be able to identify the elements of the fire tetrahedron, explain the different classes of fires and select extinguishing agents acceptable for use on the different classes of fires.

Fire is a chemical reaction known as combustion. It is frequently defined as the rapid oxidation of combustible material accompanied by the release of energy in the form of light and heat.

### 7.4.1 Fire Tetrahedron

For many years, the concept of fire was symbolized by the Fire Triangle depicting the elements needed to cause and support a fire. These three primary elements are **fuel**, **heat** and **oxygen**.

The fire triangle was changed to a **fire tetrahedron** to reflect this fourth element or
Chemical Chain Reaction. Chemical Chain Reaction describes the forces that sustain a fire after ignition has occurred.

A tetrahedron can be described as a pyramid or four sided view of the elements required for a fire to continue to burn after the three elements of the fire triangle are present.

Interrupting or removing any single element will cause a fire to extinguish. This is an important principle, and the basis for modern firefighting practices.

7.4.2 Chemical Reaction
As a fire burns and the temperature of the liquid fuel rises, fuel molecules separate into a vapor comprised of individual elements of those inside the flame, closest to the fuel. As oxygen in the surrounding air mixes with these particles, a vaporization reaction, or changing of the liquid fuel molecules into a gaseous state begins, and flame production occurs.

The area in which the vaporization and flame production occurs is called the Reaction Area. It is important to know that the least amount of reaction takes place at the base of the reaction area where there is not enough oxygen to mix with the hydrocarbon molecules.

As the number of oxygen molecules in the reaction area increase, the speed of reaction increases until energy is released in the form of light and flames. The reactions, vaporization, and flame production, are extremely rapid, even if the rate of flame spread is relatively slow.

The heat and light of the flame, or fire, is the result of the reactions taking place between hydrogen, carbon, oxygen and other elements as they unite and form new compounds.

The outermost edge of the flame is known as the flame front. There are no reactions taking place beyond the flame front. During complete combustion, only heat, water vapor and carbon dioxide are present at the flame front.

Most fires however, do not involve complete combustion and also produce carbon monoxide and carbon dioxide in the form of smoke.

7.5 Extinguishing Principles
All fires, big or small, and regardless of the fuel type, depend on the four elements of the fire tetrahedron for their existence.

As illustrated earlier, extinguishing a fire is accomplished through the interruption of one or more of the essential elements in the combustion process. The fire may be extinguished by reducing temperature, eliminating fuel or oxygen and stopping the chemical chain reaction.
7.5.1 Fire Classifications

Fires are grouped into four major classifications. They are:

- **Class A** – Ordinary combustibles
- **Class B** – Flammable and combustible liquids, greases and gases
- **Class C** – Energized electrical equipment
- **Class D** – Combustible metals

**Class A fires** involve ordinary combustibles such as wood, paper, cloth, plastics, and rubber.

**Class B fires** involve flammable and combustible liquids. This includes all aviation fuel and oil products as well as many chemicals used in cleaning and painting.

**Class C fires** involve energized electrical equipment, where the electrical current present is contributing to the chemical reaction process.

**Class D fires** involve combustible metals. In particular, Magnesium, a light-weight metal commonly used in aircraft components, burns fiercely when ignited.

7.5.2 Extinguishing Agents

How you fight a fire is heavily dependent on its class. Since the four fire classifications involve materials that are grouped into categories of similarity, so too are the types of extinguishing agents that should be administered when a fire occurs.

There are several extinguishing agents used to fight Class A, B, C or D fires. Let’s examine each of these extinguishing agents, their applicability to the different classes of
fires and their effect on the fire tetrahedron.

There are a variety of extinguishing agents in use today. Some are developed for use on a specific class of fire, while others are effective on multiple classes.

**Water** has a cooling or quenching effect that reduces the temperature below the autoignition point, thereby eliminating the Heat side of the fire tetrahedron.

Water is used exclusively on Class A fires. It must never be used on Class B, C, or D fires.

Water will spread a burning liquid fire over a larger area, making the initial fire more difficult to fight. Water used on a burning metal can result in a dangerous explosion.

If used on an electrical fire, the stream of water may act as an electrical conductor causing the electricity to follow the stream directly to your hands, causing electrical shock or death.

**Carbon dioxide**, or CO\(^2\), is a gas that extinguishes a fire by smothering it, thereby removing the Oxygen side of the fire tetrahedron.

CO\(^2\) is effective in combating class B and C fires because it has a high rate of discharge, leaves no residue, is non-corrosive and will not conduct electricity.

Because it is a gas, it is easily dispersed in windy conditions and must be used at close range. Although CO\(^2\) is not poisonous, it should be considered toxic in an enclosed area.

Most dry chemical extinguishers consist of a mixture of specially treated sodium bicarbonate that coats the surface of the burning material and interferes with the
chemical chain reaction in the flame and deprives the fire of oxygen.

Although Dry Chemical is typically used on Class B and C fires, multi-purpose or A-B-C extinguishers are also available and can be used to extinguish Class A fires.

The chemical used in dry chemical extinguishers can be difficult to clean, and can be corrosive to certain materials used in aircraft construction.

**Foam** is used to blanket flammable or combustible liquid fires and both cools and eliminates the Heat and Oxygen sides of the fire tetrahedron.

It is based upon a blend of bicarbonate of soda and aluminum sulfate and is most effective on pooled-flammable liquids, or Class B fires, where the foam can settle on the surface and minimize vapor formation. It can also be used on Class A fires.

It is not effective on vertical surfaces, or where the burning liquid is being ejected under pressure such as a broken fuel line. Dry chemical may be more effective on these types of fires.

Halogenated agents, commonly referred to as **Halon**, extinguish fires by breaking the chemical chain reaction of the combustion process by preventing the bonding of oxygen and fuel molecules.

Production of Halon ceased due to the Clean Air Act but there are Halon extinguishers used to fight fires inside aircraft cabins. These extinguishers are electrically non-conductive and do not leave residue after use. Halon is most effective in extinguishing Class B and C fires within the aircraft cabin.

Class D fires involve combustible metals. Specialized agents such as **METL-X, G-1 powder** and **Sodium Chloride** are effective in fighting the unusual characteristics presented by burning metals such as magnesium or titanium.

Class D extinguishers contain a special blended sodium chloride based dry powder extinguishing agent. Heat from the fire causes the agent to cake and form a crust, excluding air and dissipating heat from the burning metal.

The most common type of class D fire you may run into at an airport would be landing gear (made up of varying metal components) that could have ignited during landing or taxi.

Each of the extinguishing agents shown is available in portable hand-held containers. Portable fire extinguishers vary in size dependent upon the type of fire risk likely to be encountered.

All containers are clearly marked for the class or classes of fires they are approved to extinguish. Your airport or FBO will provide the type, size, number, and appropriate location of extinguishers needed to promote fire safety.

Choosing the correct fire extinguishing agent is vital to the safety of you, your coworkers and your company. Incorrect extinguisher selection can pose serious safety risks, and in
some cases, could make a bad situation even worse.

### 7.6 Fire Fighting Best Practices and Procedures

Safely and quickly extinguishing fires requires that you have knowledge of not only fire characteristics and extinguishing agents, but also of fire extinguishers and best practices for fire fighting. During this topic you will examine the equipment and procedures for fighting fires.

After completing this topic, you will be able to:

- Assess the feasibility of successfully fighting a fire.
- Relate best practices for approaching a fire.
- Describe principles of fire extinguishers used in fighting fires.
- Relate critical safety considerations to observe when fighting fires

**Ten to twenty seconds.** That is the amount of discharge agent typically contained in a portable fire extinguisher, and is a limiting factor in whether you can, or should, fight a fire.

Critical to this lesson is how to determine if it is safe for you to fight a fire, or if you should evacuate the area and immediately notify first responders.

You must consider the following before fighting a fire:

**Is the fire too large to fight?** Consider the chances of successfully extinguishing the fire. If your extinguisher is close-by and the fire just began out on the ramp, your chances of extinguishing it may be good. If you are not near an extinguisher and the fire is inside a hangar or building, it may be less likely you will be able to fight the fire. Do not attempt to fight any fire that endangers your life.

**Is it progressing too rapidly?** Consider whether professional assistance is readily available, what you must do to obtain it, and what condition the fire might be in when assistance arrives. Rapid fire growth, especially one involving a running fuel spill, may overwhelm your extinguisher. Remember in some cases, circumstances may exist in which the best alternative is not to attempt to extinguish the fire.

**Is it safe to approach?** Evaluate the risk of explosions, secondary fires, smoke and sudden growth that could further endanger your safety or the safety of others.
Could the fire block your escape route? Be cautious before entering an enclosed area with limited escape routes. A sudden change in size or direction could leave you trapped.

Do you have an appropriate extinguisher for the type of fire? You must be completely familiar with the types and sizes of fire extinguishers at your FBO or airport location as well as their capabilities for the various classes of fires.

Is the fire too hot or the smoke too thick? You must be able to get close enough to put the fire out. If the fire is too hot or the smoke too thick, you may not be able to fight the fire.

Can you completely extinguish the fire? Fires that have not been completely extinguished may flare up or reignite once the extinguishing agent is gone. Again, circumstances may exist in which the best alternative is not to attempt to extinguish the fire.

Only you can make the decision to fight or flee.

Once you have made a decision to fight a fire with a portable extinguisher, your personal safety and the safety of others will depend upon your ability to quickly and accurately assess the situation and act appropriately.

You may have only seconds to decide the most appropriate action and to evaluate whether or not to attempt extinguishing it.

Proper extinguishing technique is essential to fighting any size fire. Extinguishers could potentially be rendered useless in fighting the smallest of fires if used improperly.

Portable fire extinguishers consist of a pressurized metal container holding a limited quantity of extinguishing agent. The container typically contains a gauge that displays the pressure of the agent in the tank. Do not attempt to fight a fire if the gauge needle is below the green band.

Some extinguishers use an external nitrogen bottle to charge the extinguisher for use. A discharge valve controls the flow of agent from the extinguisher. The valve is protected from accidental discharge by a removable pin. A discharge hose and/or nozzle direct the flow of discharge agent from the tank.

7.6.1 Fire Extinguishing Principles

The principles of fire extinguisher use apply to all extinguisher types. Using a fire extinguisher is best remembered by the acronym PASS or P-A-S-S, which stands for Pull, Aim, Squeeze and Sweep.

- Remove the extinguisher from its location, approach the fire, and position yourself upwind of the blaze to prevent the fire from blowing towards you.
- Remove the discharge valve safety pin (Pull) by making a rapid twisting motion to break the safety seal.
- If your extinguisher uses an external nitrogen supply, puncture the cylinder to pressurize and activate the extinguisher.
- Remove the nozzle from its bracket and point at the base of the flame. \textit{(AIM)}
  \textbf{Remember that the reaction area is occurring at the base of the fire.}
- Move to within 10 feet of the flame and squeeze the discharge valve of the extinguisher \textit{(Squeeze)}.
- As the extinguishing agent is released, make a rapid sweeping motion at the base of the flame \textit{(Sweep)}.

\textbf{Remember…}

Never try to extinguish a fire by discharging agent in the middle or upper portion of the flame. This will only blow the fire away from its source and spread the blaze.

When the flame closest to you is extinguished, move forward and maintain the rapid back and forth sweeping motion. This will break up the reaction area located at the base of the flames and help cool the reaction area.

After the fire is out, \textbf{do not turn your back on the fire area!} Remember the heat at the surface of the reaction area, and the heat of the objects that were ablaze will be at or near autoignition temperature. There is a danger of flashback and reignition. By backing away from the fire, if flashback occurs, you will be in a position to continue spraying the fire with extinguishing agent.

The procedures shown here provide the most effective method to extinguish a fire. \textbf{Always remember P-A-S-S} or pull, aim, squeeze and sweep when fighting a fire.

Review these procedures with your supervisor and fire authority. It is important that you have actual hands-on instruction in their use. During an emergency, this training will assure maximum efficiency from your extinguisher.

Every fire is unique, and each poses its own set of challenges and risks. Your decision to fight a fire must be driven by your knowledge of fire characteristics, your assessment of the fire risk, and your skill in fire extinguisher use.

Remember, the decision to fight a fire is yours alone. Only do so when you are confident you can do it safely and successfully.
7.7 Fire Prevention

Being prepared to fight fires and knowing how to minimize fire hazards are the most effective means or promoting fire safety. Preparedness means you are ready to take action should a hazardous event occur. Minimizing potential fire hazards means taking precautionary steps when working with or near flammable materials to prevent their accidental ignition.

In this topic, you will examine preparedness and risk mitigation steps. After reading this topic, you will be able to relate the many steps you can take to promote fire safety at your operation.

Preparedness is all about being ready to respond to an event should it occur. In fire safety terms, it requires an awareness of potential risks, and the activities you may be called upon to perform. An important aspect of fire safety preparedness is your ability to quickly respond to fires or potential fire hazards.

7.7.1 Fuel Storage and Refueling Fire Extinguishing Specifications

Portable fire extinguishers must be available at all fuel farms and fixed refueling locations, on all aircraft refuelers and aircraft servicing carts, and inside hangars and office facilities as required by your airport fire safety requirements. Every extinguisher location must be clearly marked with letters at least 2 inches (50mm) high, shall be kept clear of ice and snow and must be readily accessible as needed.

The type of extinguisher and its capacity must match the potential risk.

Fuel farms and fixed refueling locations must be equipped with portable fire extinguishers of a type and capacity based on the open hose discharge capacity of the particular facility. The open hose discharge capacity is the rate at which fuel will flow from a ruptured fuel hose or component.

If the open hose discharge capacity of your fuel system is 200 gallons per minute (GPM), the facility must be equipped with at least one wheeled extinguisher having a rating of not less than 80-BC and a minimum capacity of 125 pounds of dry chemical.

Mobile refuelers shall have at least two 20-BC rated fire extinguishers, one mounted on each side of the refueler and operational at all times.

Hydrant-style service vehicles shall have one extinguisher with a minimum rating of 20-BC. Refueling cabinets must also be equipped with BC dry-chemical extinguishers.
Outdoor extinguishers must be kept free of ice and snow, and their quick-release mountings, when applicable, must be operational. **All extinguishers must be fully serviced and inspected on a regular basis.** Be proactive in extinguisher preparedness. Correct any deficiencies you encounter, and notify your supervisor if you notice extinguishers that are faulty or have expired inspection tags.

Another aspect of preparedness is knowing how to stop the flow of fuel from mobile refuelers, fuel cabinets and fuel farms if a spill or other hazardous condition should arise.

### 7.7.2 Emergency Fuel Shutoff Control Specifications

Mobile refuelers, fuel cabinets and fuel farms must be equipped with an emergency fuel shutoff, capable of overriding all other fuel controls, and stopping all fuel flow with one physical movement.

Emergency fuel shutoff controls should be clearly marked with bold lettering of at least 2 inches (50 mm) high and indicate **PUSH or PULL as applicable.** Preparedness requires that you verify proper operation of emergency shutoff valves prior to fueling operations.

### 7.7.3 Deadman Shutoff Control Specifications

Knowledge of deadman shutoff controls is also required for preparedness of certain refueler activities and fuel storage facility fuel transfers. A deadman shutoff control is used by the operator of a refueler or fuel storage facility and is a hand held unit that is spring loaded into the OFF position. As the operator grips the deadman, the connection closes and allows fuel to flow. The deadman shutoff will automatically stop the flow of fuel if the operator’s grip is released for any reason such as inattentiveness or incapacitation.

Deadman shutoff controls must be used during single-point refueling and during bottom loading of a refueler at the fuel storage facility. The flow control valve or grip on an over wing nozzle is considered a deadman.

**Jamming or otherwise fixing the deadman control into the “on” position with a device other than the operators hand, is strictly prohibited.** Defeating the fail safe purpose of the deadman control is a strict violation of safety procedures.

Preparedness includes placards and identification markings to assist in an emergency such as a fire or fuel spill. All fuel service vehicles are required to display a sign on both sides and the rear of the vehicle with the type of product being transported.
7.7.4 Fuel Storage and Refueling Equipment Placarding
The U.S. Department of Transportation (DOT) has established a series of identification numbers for specific types of fuel; **Avgas** is 1203 and **Jet-A** is 1863. If an emergency such as a fire or fuel spill occurs, the identification of the fuel involved will ensure that the contents are easily recognizable and will enable emergency personnel to decide how to handle the situation.

In accordance with the American Petroleum Institute (API) Standard, specifications for placarding of fuel storage facilities and equipment should include; **Avgas 100LL**, identified by **white letters on a red background next to a single blue band** and **Jet-A**, identified by **white letters on a black background next to a single black band**.

In an ideal world, it is hoped that you will never have to use the fire safety skills you have learned thus far. The best way to make this happen is to work diligently to minimize the many potential fire risks that exist at your operation.

7.8 Clothing and Other Static Generating Equipment and Materials
In this section, we will examine fire risks that exist during different phases of fuel handling, with emphasis on equipment condition, static electricity, and potential ignition sources.

Did you know that the clothing you wear can pose a fire risk during fueling operations? Clothing made of silk, polyester, wool, or nylon and wool blends are good generators of static electricity, and should not be worn. **Clothing made of 100% cotton is generally considered the safest when handling fuels.**

Shoes that provide support made of **leather with rubber soles and safety toes are the safest footwear** for refueling operations. Shoes or boots with steel taps or screws should not be worn. These shoe features can generate sparks when they come into contact with paved ramp surfaces.

And do not wear regular tennis shoes unless they are designed with safety toes. They do not provide protection if a refueling nozzle or tow bar falls on your foot.

In addition to your clothing, **DO NOT carry any objects that could pose a fire risk within 50 Feet of any fuel tanks, refuelers, aircraft, fuel farms, loading docks and storage areas.** These include smoking materials (no lighters or matches of any kind),
portable electronic equipment (such as cell phones or MP3 players), and any other device that could cause a spark if operated, dropped, bumped, or hit. **Only approved “explosion proof” devices are allowed.**

**Do not continue to wear clothing that has become saturated with fuel.** Beyond the skin irritation that contact with fuel can cause, fuel on clothing is an extreme fire hazard.

If you spill fuel on your clothes, remove the contaminated clothing immediately or as quickly as practical. Be especially cautious of ignition sources during removal. Exposure to heaters, matches or cigarettes being used by other personnel presents a very real personal hazard. Wash exposed areas of the skin with plenty of soap and water. Aviation fuels remove the natural oils from the skin and can cause skin irritation.

Do not assume that once the fuel has evaporated that the clothing is “fire safe.” Clothing that has been exposed to fuel remains highly flammable, even when the fuel itself has evaporated.

Although this section deals with potential fire risks, **DO NOT** carry loose items in shirt pockets as a safety precaution. Loose items in shirt pockets can easily fall into aircraft fuel tanks or refueler tanks causing contamination of the fuel and severe damage to filters and pump systems. **Leave pens and other items in the refueler.**

### 7.8.1 Refueler Fire Risks and Best Practices

Mobile refuelers must be carefully checked for condition prior to use in refueling operations. **Mobile refuelers contain many special design features to reduce potential fire risks.** These features include shielding to safely drain potential fuel spills or leaks away from the exhaust system or other potential ignition source. Exhaust systems will direct exhaust gases far away from fuel vapors and terminate into a standard baffled muffler at the front of the vehicle. These special engine air filter flame arrestors enclose flames in the event of an engine backfire. Under no circumstances should these systems be removed or altered! **Make sure you understand the special features on your company’s refuelers.**

Minimize fire risk on the refueler by:

- Ensuring that all required safety equipment is on the vehicle and operational.
- Check the condition of bonding cables and reels. The bonding cable and bonding clip should not be worn or frayed.
- Check the condition of fuel hoses and nozzles.
- Verify the proper operation of the emergency fuel shutoff system and appropriate
labels for operation.

The **distance that a refueler is parked** from aircraft and airport structures is important to fire safety, and to the safety of personnel in the vicinity of the refueler.

- Refuelers must not be parked closer than **10 feet or 3 meters** from other refueling equipment.
- Refuelers shall not be parked closer than **50 feet or 15 meters** to an aircraft, except during a refueling operation.
- Refuelers shall not be parked closer than **50 feet or 15 meters** from any building, including airport terminals, cargo buildings, hangars, or other airport structures housing the public.
- During refueling operations, the refueler shall be parked no closer than **10 feet or 3 meters** from aircraft fuel vents. Vapors from fuel vents could come into contact with vehicle ignition sources, creating a fire risk.

### 7.8.2 Equipment Best Practices

Many seemingly routine tasks present the potential for static electrical discharge and fire. The use of plastic funnels and buckets is one example. They are an excellent generator of static electricity and create a significant fire hazard.

You can minimize the fire risk by always using a large **high-quality non-galvanized metal funnel or stainless steel container** whenever fuel needs to be funneled into any type of container or tank, such as a sump tank. The funnel must remain in contact with the filler opening of the container or vessel during the fuel handling operation. This procedure reduces or eliminates the potential for static discharge between the two surfaces precipitated by the movement of the fuel.

The passage of fuel through hoses during mobile refueler loading and aircraft fueling procedures can produce large amounts of static electricity. Minimizing static electricity and the fire risk it poses is therefore essential.

Conductive hoses that meet the American Petroleum Institute or API type C standards are used to reduce the accumulation of static electricity. **Conductive hoses alone are not sufficient to eliminate the potential static electricity risk.**

### 7.8.3 Bonding Best Practices

The **elimination of static potential is accomplished through the use of bonding cables.** It is your responsibility to ensure that aircraft and refuelers are properly bonded together before commencing any refueling or de-fueling operation.

Static electricity can provide a split-second spark that can be a source of
ignition for all types of fuels, including avgas and jet fuels.

The results of an inadvertent static discharge during fueling or refueling operations can be disastrous. All refueling equipment shall be bonded to the aircraft by use of a cable, providing a conductive path to equalize the potential between the refueling equipment and the aircraft.

The bonding connection must be an unpainted metal point on the aircraft, typically a non-cast metal part on the landing gear. There may be a special bonding lug or other unpainted surface designated by the aircraft manufacturer.

This bonding connection must be made before fuel flow commences, and must be maintained until after fuel transfer procedures are completed and all filler caps are closed.

7.8.4 Static Electricity Sources and Best Practices

How does static build-up happen? We will outline two completely different scenarios:

First, aircraft that have recently returned from flight provide a strong potential source of static electricity. High speed flight, precipitation, and clouds can all cause electrostatic charge to build up and reside on the aircraft skin or other metal within the aircraft such as the metal heat coil within the windshield.

Another scenario, and the most common source of electrostatic build-up, occurs during the movement of fuel from the fuel storage facility into the refueler, or from the refueler into the aircraft. As the fuel passes through the filter, the pluses are separated from the minuses. As the fuel passes onward, one or the other -- plus or minus, travels along with the fuel, and the other stays behind in the filter creating a large voltage difference.

It is important to note that it may take 3 minutes or more for static potential to dissipate through the bonding cables. Always allow adequate time for static electricity to dissipate before commencing refueling or de-fueling operations.

Additionally, when overwing refueling, the nozzle shall be bonded with a nozzle bond cable having a clip or plug that attaches to a metallic component of the aircraft near the tank filler port. The bond connection shall be made before the filler cap is removed.

If there is no plug receptacle or means for attaching a clip, briefly touch the hose nozzle to the filler cap before removing the filler cap. This will equalize the potential
between the nozzle and the cap and greatly reduce the likelihood of a spark.

Important points to remember…
- Keep the filler nozzle in contact with the filler neck throughout the refueling procedure.
- Use only approved bonding points designated by the aircraft manufacturer.
- The same bonding requirements exist during fuel transfer of any kind. A bonding cable must be provided between the refueler being loaded and the loading dock, between refuelers or hydrant carts and the aircraft, and between the fuel cabinet and the aircraft.
- When loading or transferring fuel from fuel storage into the fuel service vehicle, bonding connections must be maintained until after the dome cover(s) are securely closed and the loading hose has been disconnected.

It should be noted that the National Fire Protection Association (NFPA) has determined that the bonding of aircraft and refueling vehicles is the safest method for refueling. NFPA 407’s Aircraft Fuel Servicing provides standard guidance to ensure best practices for fire risk assurance for all fueling operations.

Local procedures and regulations may require grounding of the aircraft and vehicles through an appropriate earth ground. This procedure is NOT recommended by the NFPA 407. Check with your supervisor for specific compliance requirements to local rules and regulations regarding refueling operations.

7.9 Refueling Safety Best Practices

Some equipment could cause a fire risk. When refueling, ensure that all motors, engines, radios, and other mechanical or electrical equipment are turned off and remain off. Pay attention, in particular to the following;
- Aircraft radar can create a potential ignition source. Be sure to check with the flight crew to make sure that all radar equipment is turned off during refueling.
- Ground Power Units (GPU’s) must be started and connected before approaching the aircraft for refueling.
- GPU’s should never be connected or disconnected during refueling operations.
- Auxiliary power unit (APU) may be running during refueling operations.
Check with your supervisor for any additional approved equipment that may be running during refueling operations.

It is considered best practice for all passengers to be off the aircraft during refueling.

7.9.1 Refueling Aircraft with Passengers Onboard

If passengers are onboard, there must be at least one qualified flight crew member, trained in emergency evacuation procedures, (for the aircraft being refueled) in the aircraft near an exit where passengers can be deplaned in the event of a refueling emergency.

Cabin “No Smoking” signs must be illuminated, and the no smoking rule strictly enforced by the flight crew during the refueling operation.

If you are required to refuel an aircraft with passengers onboard that are not ambulatory, many airport authorities require that the fire department stand-by the aircraft during refueling. Check with your supervisor concerning local requirements.

No Smoking signs should be clearly displayed at the entrance to your ramp area to inform passengers that smoking is not allowed on the aircraft ramp. Make sure all other employees and ramp personnel know and follow these rules.

7.9.2 Refueling Best Practices on Active Ramps

If passenger vehicles are allowed on your ramp, remain observant for vehicles approaching the aircraft to load or unload passengers and baggage. Stop refueling if any passenger vehicle comes within 50 feet of the refueling operation. Replace the filler cap until the vehicle has moved more than 50 feet away.

Always remember, bonding cables must be in place before opening fuel filler caps or access panels.

Remain aware of aircraft movements in your vicinity during refueling. In particular, be cautious of turbine powered aircraft. Jet engine exhausts can reach temperatures over 900º Fahrenheit and speeds more than 500 miles per hour. Refueling operations in active ramp areas must be conducted with extreme caution.
DO NOT conduct fueling operations within 150 feet directly downstream from the exhaust nozzle of an operating jet engine, nor 75 feet downstream of an operating turboprop engine. If turbine powered aircraft are operating within these distances, discontinue fueling, replace the filler cap, and wait for the aircraft to clear the area.

### 7.9.3 Refueling and Thunderstorm Best Practices

Thunderstorms precipitate lightning strikes over a wide area and create an abundance of static electricity in the air that can create a hazardous condition during fuel transfer operations.

The decision to suspend fuel operations during thunderstorm activity is based upon experience and assessing storm criteria such as direction of travel, distance from the airport, and intensity. As a general rule, fueling operations should not be conducted when a thunderstorm is within 5 miles of the airport.

Your supervisor will review specific thunderstorm procedures at your operation.

You can estimate the distance to the lightning by doing some simple math. Sound travels about one fifth of a mile per second. Count the number of seconds from the lightning flash to the sound of the thunder, and divide this number by five. This gives the rough distance in miles.

### 7.9.4 Safety and Refueling Best Practices

Exercise care during fuel receiving and loading operations to minimize fire risk. This care begins with ensuring all unauthorized personnel are restricted from the fuel receiving and loading areas by appropriate fencing. Fences must be in good repair and all gates locked to ensure entry to the facility.

Signage must include No Smoking and Flammable signs displayed in prominent, high visibility locations around each side of the fence at the fuel farm facility.

You must also maintain a clean fuel farm to prevent accumulation of weeds or other materials that could pose an ignition risk.

Properly bond all vehicles, including delivery tankers, before beginning any receiving or loading operation. This eliminates the static electricity potential caused by movement of fuel through fuel hoses.
During receiving or loading procedures, **never override or bypass the safety features of the deadman fuel flow control feature.** The deadman switch and emergency shutoff valve it controls is your main protection against fuel spills if a hose should rupture.

All hoses, nozzles and outflow connectors must be controlled by a deadman fuel flow control feature, that is capable of stopping the flow of fuel with one physical movement.

### 7.10 Fuel Spill Handling and Best Practices

Fuel spills can happen without notice and pose great risk to personnel and property.

Your role is to follow procedures that will minimize the potential for fire and maximize the level of safety for you and others involved. You must first stop the flow of fuel to limit the size of the spill, and then as practical, contain the spill.

It is important to remember fuel spill handling procedures can vary depending on the size of the spill, the type of flammable or combustible liquid involved, the arrangement of equipment at the spill site, the occupancy of the aircraft and the availability of emergency equipment and personnel.

You must minimize potential fire risks during a fuel spill. When a spill occurs, **your first reaction must be to determine the source-- and stop the flow of fuel,** thereby limiting the size of the spill.

In the case of a refueling vehicle, close the emergency shutoff valve immediately. If the spill can not be stopped because of a component failure, your actions should be directed at minimizing risk to personnel and property.
Fire risk is minimized through your prompt actions;

- Call for assistance by notifying your supervisor and airport fire authority as soon as practical.
- Remember to post an extinguisher a safe distance upwind from the spill so that it is available if the need arises.
- Beyond the obvious fire hazard, spills also pose an environmental hazard.
- If the spill involves your refueler, do not remove it. If the engine is shut-off, do not start it. If the engine is running, leave it running. Ignition of the spill is more likely to occur from engines backfiring during start-up or shut-down.
- This applies to all electrical equipment as well. Do not start or turn off any equipment in or near the spill.
- Position warning cones around the perimeter of the spill to prevent vehicles from entering the spill area and direct any approaching vehicles away from the hazard area.
- If you are properly trained and have the proper equipment, you may start to clean up the spill.
- If you do not have the appropriate equipment, stand by your fire extinguisher and direct traffic from the area. The fire authority has the proper equipment and personnel to deal with the situation safely.

Appropriate spill kits must be available on each refueler, and your operation should also have a spill recovery cart or other vehicle available for various types of spills. For very large spills your supervisor will instruct you regarding the appropriate agencies and response organizations to contact for assistance with large fuel spill emergencies. Professional help is available from the Spill Center at http://72.52.185.58/~staterep/inf_links_orig.php

Fuel spills pose a very real threat to safety. Therefore, remember these three key steps;

- Stop the flow of fuel
- Secure the area until the fire department arrives
- And direct traffic away from the area

7.11 You Are Responsible for Fire Safety on Your Ramp

There are remarkably few ramp fires each year especially when you consider the number of operations undertaken each day involving fuel. The steps you actively take to
minimize fire hazards will help keep this number low!

Preparedness and minimization of risk are the backbone of fire safety. Throughout this topic you have been introduced to the many practical steps and precautions you must take to prevent fires from occurring. **It is your responsibility to know and learn procedures and best practices that promote fire safety, and to put them into action every time you walk onto the ramp.**
REMEMBER: A fire is made up of three (3) elements:

1. Fuel
2. Oxygen
3. Heat

REMEMBER: To extinguish a fire:

1. Cut-off the oxygen
2. Reduce the temperature (heat)
3. Remove fuel

**FIRE TRIANGLE**

**Fuel**

**Heat**

**Oxygen**

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**FACTS TO REMEMBER**

**Flash point of:**

- Avgas = -50°F
- Jet A = 100°F

**Flammability range of:**

- Avgas:
  - Lower limit = 1.4%
  - Upper limit = 7.6%
- Jet A:
  - Lower limit = 0.74%
  - Upper limit = 5.32%

**Autoignition temperature of:**

- Avgas = 840°F
- Jet A = 475°F

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**DEFINITIONS TO KNOW**

**Flash point:** Of a fuel is the lowest temperature at which the liquid fuel gives off sufficient vapors to form an ignitable mixture of fuel and air.

**Why this is important:**
If an ignition source is introduced to the surface of the fuel, and it is at or above the flash point temperature, the vapor can ignite!

**Flammability:** Of the mixture is determined by the mixture of fuel and oxygen. The flammability of aviation fuel is defined as the percentage (%) of fuel in the air which will allow ignition to occur.

**Why this is important:**
There is an upper and lower limit to the flammability ratio. Any mixture of fuel and air that falls within these ranges is ignitable and will burn continuously once ignited.

**Autoignition:** Is the temperature at which fuel will automatically ignite without a spark or other outside ignition source.
Water: Has a cooling effect which reduces the temperature of the burning material, eliminating the heat side of the triangle.

Beware of water --- used on Class A fires, NOT other classes of fires. But, it can be the best cooling agent for your own personal protection from heat.

DO NOT USE WATER ON ELECTRICAL FIRES

Carbon Dioxide (CO2): Extinguishes fires by smother, eliminates the oxygen side of the triangle.

Use on: Class B or C fires

Dry Chemical: Most dry chemical extinguishers consist of a mixture of specially treated sodium bicarbonate, eliminating the oxygen side of the triangle and also interferes with the chemical reaction.

Use on: Class B or C fires, some extinguishers are rated A

Foam: Is a blend of bicarbonate of soda and aluminum sulfate, which when mixed with water creates a foam when expelled from a canister under pressure. When it "blankets" the fire, it cools and eliminates the heat and oxygen sides of the fire tetrahedron.

Use on: Class B fires and sometimes Class A, but is especially effective on pooled flammable liquids.

Halon: Is a liquefied gas which acts to break the chemical chain reaction of the combustion process by interrupting the supply of oxygen.

Use on: Class B or C fires

Beware: Halon is being phased out because it breaks down the ozone layer and disperses in the wind.

Potential Sources of Heat to Be Aware of

- Brakes
- Mufflers
- Wheels
- Broken lights
- Engines
- Exhaust manifold

Did You Know?

Static electricity can take up to 3 minutes to dissipate through the bonding cable.

In some cases, circumstances may exist in which the best alternative is not to attempt to extinguish the fire.

How Do You Evaluate the Situation? Ask These Important Questions

What size is the fire? Is the fire too large?

Is the fire progressing too rapidly?

Can the fire be completely extinguished?

Is the fire extinguisher appropriate for the type of fire?

Can you assess what class of fire it is?

Can the fire block your escape?

Is there danger of an explosion or other condition which may further endanger your safety or the safety of others?

Is professional assistance available and what must you do to obtain it?

What condition will the fire situation be in when assistance arrives?
Heat of Combustion: The heat generated from the burning of fuel is measured in British Thermal Units (BTUs)

What is a BTU
The quantity of heat required to raise the temperature of 1 pound of water 1º degree Fahrenheit.

Why this is important
It is important to understand that some fuels burn hotter than others.

Rate of Flame Spread: Once fuels have been ignited, there is a marked difference in the rate of flame spread for different fuels.

Why this is important
This is very important in evaluating the severity of a fire.

Did You Know……..
When a pool of spilled fuel has been ignited, the rate of flame spread for Avgas is approximately 30 times greater than Jet A.

BUT, when fuel is released in mist form (like in an aircraft accident) the rate of flame spread will essentially be the same.

Fire Tetrahedron: Is a four sided view of the elements which also includes the chemical reaction.

Why is this important
All 4 sides are required for a fire to continue to burn after the 3 elements of the fire triangle are present.

Classes of Fires

Class A
Ordinary Combustibles

Class B
Flammable & Combustible liquids, greases & gases

Class C
Energized Electrical Equipment

Class D
Combustible Metals

U.S. DOT Identification Numbers:
Avgas = 1203
Jet A = 1863

FAR 139

Did You Know…………
This Federal Aviation Regulation requires fuel service providers to have at least one (1) supervisor trained in aviation fuel handling and fire safety.
REMEMBER: Most portable fire extinguishers have only 10 to 20 seconds of discharge capability.

**Using a Portable Extinguisher**

**Position** yourself upwind from the blaze

Break the safety seal and remove the safety pin

Press the tab to pressurize the nitrogen cylinder

Point the nozzle at the base of the flame

Move to within **10 feet** of the flame

As the flame is extinguished, **steadily move forward**

Maintain a rapid **BACK and FORTH motion**

After the fire is out, **DO NOT TURN YOUR BACK ON THE FIRE** because there is a danger of flashback and re-ignition

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**REMEMBER** the acronym for operating a portable fire extinguisher

**P** Pull the safety pin

**A** Aim the nozzle

**S** Squeeze the trigger

**S** Sweep the base of the flame

---

**Required Markings on piping and headers at the fuel storage:**

(In accordance with API 1542)

Avgas 100LL

Jet A

Portable fire extinguisher with lettering at least 2 inches or more.

---

**What Actions You Should Take Immediately for a Fuel Spill**

**STOP** the flow of fuel

**Notify** supervisor and airport fire authority

Place fire extinguisher **UPWIND** of spill

Do not start, turn off or move any equipment

Position warning cones around spill

Direct traffic **away** from spill area

If properly trained with proper equipment, start cleanup
Safety Measures and Requirements for Personnel, Facilities and Equipment

Mobile refuelers: Must have an emergency fuel shutoff, capable of overriding all other fuel controls. It must be able to stop all fuel flow with one physical movement.

Also required to be equipped with an air filter/flame arrestor equipment and a leak free exhaust system which terminates into a standard baffle muffler at the front of the vehicle.

Deadman Shutoff: Used by the operator of the mobile refueler or fuel storage facility and is a hand held unit which is spring loaded into the "OFF" position. A deadman shutoff must be utilized during single point refueling and when bottom loading a mobile refueler.

Jamming or fixing the deadman control into the on position with a device other than the operators hand is strictly prohibited.

Acceptable clothing: Clothing made of 100% cotton and leather boots with rubber soles are generally considered safe during refueling.

Refueling personnel should not carry any type of igniting device at any time.

Bonding: Must be completed during fuel transfer of any kind. (ie., operations from fuel storage to fueling vehicle, refueler to hydrant cart, truck to truck or hydrant cart to aircraft or fueling cabinet to aircraft.

Bonding connection must be made on an unpainted metal point on the aircraft.

Plastic funnels and buckets: SHOULD NOT BE USED for handling fuel due to static electricity

Use high quality, non-galvanized metal funnel

When using a funnel, it must always remain in contact with the filler opening during fuel handling operations.

Fire Extinguishers: Each aircraft fuel servicing vehicle shall have at least 2 "20-BC" rated fire extinguishers mounted on either side of the vehicle and operational at all times.

Each hydrant service vehicle shall have 1 extinguisher with a rating of not less than "20-BC".

Refueling nozzle: If there is no plug or receptacle at the over wing filler point, the proper procedure is to touch the filler cap with the fuel nozzle before removing the cap.

Refueling with passengers on board: Requires at least one qualified flight crew member, trained in emergency evacuation procedures, for the aircraft being fueled, must be in the aircraft, near an exit, where passengers can be deplaned in the event of a fueling emergency. (Nonsmoking signs must be illuminated.)

Refueling near vehicles: Must cease whenever a vehicle is within 50 feet of the aircraft.
OSHA Fire Safety Advisor

OSHA’s Fire Safety Advisor is interactive expert software. It will help you understand and apply OSHA’s Fire Safety related standards. You can use this Advisor online, or download it and run it in the Windows environment.

It addresses OSHA’s general industry standards for fire safety and emergency evacuation (Subpart E, 29CFR1910.36, 37, and 38). It also addresses OSHA standards for firefighting, fire suppression and fire detection systems and equipment (Subpart L, 29CFR1910.156 through 165).

This expert software will interview you about your building, work practices, and policies at the facility, to determine whether and how OSHA’s Fire Safety standards may apply.

The Fire Safety Advisor 1.0:
- asks you about workplace conditions, practices, and policies,
- analyzes your answers with expert decision-logic,
- alerts you to fire safety hazards,
- points out applicable OSHA standards,
- tells you what aspects of these standards apply to your situation,
- helps you conduct detailed compliance reviews,
- helps you write customized “Emergency Action Plans” and “Fire Prevention Plans,”
- shows you pop-up (hypertext) definitions of keywords and phrases,
- gives you reformatted and very readable copy of the regulations, and other help.

Download and install OSHA Fire Safety Advisor

The software is distributed from the OSHA Web site as a single archive file, FSA.ZIP. This is a large file (2.3 mb) because it is a Windows program. It will take about 11 minutes to download with a 28,800 baud modem. We suggest that you copy this file into a TEMPORARY subdirectory named C:\TEMPFSA.

Click here to download the OSHA Fire Safety Advisor

After copying the program distribution file to C:\TEMPFSA:

1. Use Windows File Manager to browse to C:\TEMPFSA, select FSA.ZIP, and double click to extract the file FSA.EXE from it and place it in the same directory. (Note: you must have an archive program which will decompress the ZIP archive. If you do not have a decompression program installed on your computer, there are several free or low cost programs which may be downloaded from the Internet.)
2. Then double click on FSA.EXE to install the software on your computer.
3. Once you have installed the Fire Safety Advisor, you may safely delete the file FSA.ZIP. FSA.EXE may also be deleted, but it is recommended that it be kept so that you may reinstall the advisor, if necessary.

The Fire Safety Advisor program will then be available on your computer by selecting Start/Programs/OSHASOFT/Fire Safety Expert Advisor/Fire Safety Expert Advisor.
How does 14 CFR 139 apply to fueling operations?

Airports that hold a Part 139 certificate are required to establish and maintain standards to protect against fire and explosion during fuel handling operations. Airports and fuel handling operations must comply with the requirements of 14 CFR 139.321.

Who must be trained under 14 CFR 139?

"At least one supervisor with each fueling company on the airport shall have completed an approved aviation fuel fire safety course."

It is then the responsibility of that supervisor to provide training to the other employees of his or her company.
Regulatory Requirements

What are the airport’s requirements under 14 CFR 139?

The airport must:
- Set standards for fire safety (based upon local fire code)
- Enforce those standards
  - Inspection of fueling facilities at least once every three months

Requirements for “Approved Fire Safety Course”

- Must provide training on:
  - Bonding
  - Public protection
  - Control of access to storage areas
  - Fire safety in fuel storage areas
  - Fire safety in mobile refuelers, fueling pits and cabinets
  - Training of personnel in fire safety

NATA COVERED THESE AREAS WITH THE ONLINE PLST TRAINING

Your Requirements

It’s your obligation to request and obtain the training required under 139.321(b)(7) - Fire code of the public body having jurisdiction over the airport ...

It is your responsibility to go to your fire authority and receive training on the local fire code.

It is also recommended that you perform a “LIVE” fire exercise using a portable fire extinguisher.
HOW WELL DO YOU KNOW
YOUR FUEL?
Jet A Vs Avgas

How Well Do You Know Your Fuel?

WHAT IS FLASHPOINT?
Lowest temperature at which the liquid fuel gives off vapor in sufficient concentrations to allow it to ignite.

Why FLASHPOINT is important
If an ignition source is introduced to the surface of the fuel, and it is at or above the flashpoint temperature, the vapor can ignite.
How Well Do You Know Your Fuel?

Know Your Flashpoint Temperatures!

Avgas - 50°F Fahrenheit

Jet A - 100°F Fahrenheit

WHAT IS FLAMMABILITY RANGE?

Percentage of fuel in the air that will allow ignition to occur

Why FLAMMABILITY is important

If a fuel/air mixture of aviation fuel is within flammability range, it is ignitable and will burn continuously
How Well Do You Know Your Fuel?

Flammability Range of Avgas
Lower limit = 1.4%
Upper limit = 7.6%

Flammability Range of Jet A
Lower limit = 7.4%
Upper limit = 5.32%

How Well Do You Know Your Fuel?

What if it falls outside of these limits?
> Upper limit = too rich to ignite
< Lower limit = too lean to ignite

How Well Do You Know Your Fuel?

WHAT IS AUTO-IGNITION?

Temperature at which fuel will automatically ignite without a spark or other outside ignition
How Well Do You Know Your Fuel?

**Auto-ignition Temperatures?**

<table>
<thead>
<tr>
<th>Fuel Type</th>
<th>Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avgas</td>
<td>840°F</td>
</tr>
<tr>
<td>Jet A</td>
<td>475°F</td>
</tr>
</tbody>
</table>

**Rate of Flame Spread:** Once fuels have been ignited, there is a marked difference in the rate of flame spread for different fuels.

Why is this important?

It can assist you in evaluating the severity of a fire.

The flame spread of Avgas is 30x greater than Jet A in pooled fuel.

If fuel is in mist form, the rate of flame spread is the same.
How Well Do You Know Your Fuel?

U.S. DOT Identification Numbers

Avgas 1203
Jet A 1863

CLASSES OF FIRES

A, B, C, D

FIRE SAFETY TRAINING Classes of Fires

Class A: Wood, paper, cloth, trash, plastics—solids that are not metals
Class B: Flammable liquids—gasoline, oil, grease, acetone. Includes flammable gases
Class C: Electrical—energized electrical equipment. As long as it’s “plugged in”
Class D: Metals—potassium, sodium, aluminum magnesium
Classes of Fires

Class A fires generally leave an Ash

Class B fires generally involve materials that Boil or Bubble

Class C fires generally deal with electrical Current
Hey, what about Class D Fires?

FIRE SAFETY TRAINING
The Fire Triangle

FIRE SAFETY TRAINING Extinguish Fire

Three things must be present at the same time to produce fire:

- Enough **OXYGEN** to sustain combustion
- Enough **HEAT** to reach ignition temperature
- Some **FUEL** or combustible material

Together, they produce the **CHEMICAL REACTION** that is **FIRE**
FIRE SAFETY TRAINING

POTENTIAL SOURCES OF HEAT

• Brakes
• Mufflers
• Wheels
• Exposed lights
• Engines
• Exhaust Manifolds

— Static electricity

can take up to 3 minutes to dissipate through the bonding cable

SO, YOU’VE GOT A FIRE

Now what?
In The Event Of A Fire:

- Evaluate the fire
- What type of fuel is involved
- What is the size of the fire
- Could the fire block your escape
- Is there a possibility of an explosion
- Do you have the appropriate equipment to extinguish the fire
- Is professional assistance available
- In what condition will the situation be when help arrives

In The Event Of A Fire

Now, you must make a decision. Do you attempt to extinguish the fire or evacuate the area?

YOU ARE NEVER EXPECTED TO PUT YOUR SAFETY AT RISK IN REACTING TO A FIRE!

USING A FIRE EXTINGUISHER
Using A Fire Extinguisher

**FIRE EXTINGUISHERS – How long will they last?**

Most portable fire extinguishers have only **10 to 20 seconds** of discharge capability.

---

10 to 20 seconds! What good is that?

That might be just enough time for you to escape!

---

Using A Fire Extinguisher

**Acronym for proper use of a fire extinguisher?**

- **P** --- **Pull** the safety pin
- **A** --- **Aim** the nozzle
- **S** --- **Squeeze** the trigger
- **S** --- **Sweep** rapidly at the base of the flame
Using A Fire Extinguisher

The fire is almost out, what do you do now?

Steadily move forward

Maintain rapid back and forth

Using A Fire Extinguisher

NEVER TURN YOUR BACK ON THE FIRE

DANGER: flashback and re-ignition

NATIONAL FIRE CODE REVIEW

NFPA 407
National Fire Code Review

- NFPA 407 – Standard For Aircraft Fuel Servicing
- Standard vs Local Code

FIRE SAFETY TRAINING

Fire extinguisher requirements for REFUELERS?

At least 2 “20-BC” rated fire extinguishers mounted on either side of the vehicle and OPERATIONAL at all times

FIRE SAFETY TRAINING

Hydrant service vehicle requires?

1 extinguisher rating not less than "20-BC"
FIRE SAFETY TRAINING

ACCEPTABLE CLOTHING?

100% **cotton** and leather boots with oil resistant rubber soles

FIRE SAFETY TRAINING

**FUNNEL USE**

Use high quality, non-galvanized metal funnel

Do NOT use plastic funnels or buckets --- Generate too much static electricity

FIRE SAFETY TRAINING

**Bonding**

Must be completed during fuel transfer of any kind
- From fuel storage to fueling vehicle
- Refueler to hydrant cart
- Truck to truck
- Hydrant cart to aircraft
- Fueling cabinet to aircraft
DEADMAN OPERATION

Jamming or fixing the deadman control into the on position with a device other than the operators hand is strictly prohibited.

Refueling Nozzle

If no plug or grounding receptacle is apparent at or near the over wing filler point, THEN....

Touch the filler cap with the fuel nozzle before removing the cap to dissipate any static charge.

Emergency Shutoff

Must be capable of overriding all other fuel controls...and...

STOP fuel flow with one physical movement.
FIRE SAFETY TRAINING

Refueling with Passengers

- One qualified flight crew member, trained in emergency evacuation procedures
- Crew must be in the aircraft near an exit
- NO SMOKING sign must be illuminated

PREVENTING A FIRE IN THE FIRST PLACE!

Handling Fuel Spills

FIRE SAFETY TRAINING

IMMEDIATE Fuel Spill Procedures

- STOP the flow of fuel
- Fire extinguisher UPWIND
- NOTIFY your supervisor and fire authority
FIRE SAFETY TRAINING

ADDITIONAL Fuel Spill Procedures

- DO NOT start, turn off or move any equipment
- DIRECT traffic away from area
- ASSEMBLE equipment and spill materials
- COMMENCE cleanup when authorized by fire authority

Course Certification

YOU'RE NOT DONE UNTIL THE PAPERWORK IS COMPLETE!

FIRE SAFETY TRAINING

REMEMBER: It's your obligation to request and obtain the training required under 139.321(b)(7) - Fire code of the public body having jurisdiction over the airport ...

It is your responsibility to go to your fire authority and receive training on the local fire code.

It is also recommended that you perform a "LIVE" fire exercise using a portable fire extinguisher.
SAFO 10020 Hot Fueling
Subject: 14 CFR, parts 91, 133, and 137 and hot fueling/loading

Purpose: This SAFO highlights current guidance and best-practices for Title 14 Code of Federal Regulations (14 CFR) parts 91, 133, and 137 operators that conduct fueling or chemical loading with the engines running (hot fueling/loading).

Background: On May 30, 2009, a Bell 47G-2 helicopter operating under part 137 was being refueled with the engine running (hot fueling) when the ground crew spilled fuel onto the engine while trying to untangle a kink in the hose. The helicopter quickly caught fire and the pilot sustained serious injuries as a result. Additionally, on September 9, 2008, a Bell 206-B helicopter, operating under part 137, sustained substantial damage while conducting hot fueling and chemical loading simultaneously. After fueling was complete, but with the chemical hose still attached, the ground crew mistakenly gave an “all clear” hand signal to the pilot. As the pilot ascended, the chemical hose caused the helicopter to pitch nose down and roll to the right, contacting the ground.

Recommended Action: Hot fueling/loading can be extremely hazardous and is not recommended except when absolutely necessary due to the nature of the operation. Operators who conduct hot fueling/loading should develop standard operating procedures (SOP) for flight and ground crew personnel. The operator’s procedures should address the following guidelines:

- The Federal Aviation Administration (FAA) recommends that hot fueling be conducted only by aircraft utilizing JET A or JET A-1 fuel types. If strict operating procedures are not followed, hot fueling of aircraft utilizing AvGas can be extremely hazardous due to its low flash point. Aircraft being fueled while an engine is operating should have all potential ignition sources located above the fuel inlet port(s) and above fuel vent or tank openings. Sources of ignition include, but are not limited to: engines, exhausts, auxiliary power units (APU), and combustion-type cabin heater exhausts. In accordance with 14 Code of Federal Regulations (14 CFR) section 91.9, hot fueling is not permitted if the Airplane or Rotorcraft Flight Manual contains an associated operating limitation.

- An appropriately certificated and rated pilot should be at the flight controls during the entire hot fueling/loading process with controls appropriately adjusted to prevent aircraft movement. The pilot should unbuckle all restraints, and be prepared to immediately shut-down the engine and egress the
aircraft, if necessary. The pilot should not conduct any extraneous duties during hot fueling/loading. Other personnel should not be on-board the aircraft during hot fueling/loading.

- Only designated personnel, with proper training in hot fueling/loading operations, should operate fueling or chemical loading equipment. The operator’s written procedures should include: precautions for safe handling of the fuel or chemical, emergency shutoff procedures, fire extinguisher use, hand signal use, and precautions regarding moving propeller and rotor blades.

- At least two ground personnel should be present during hot fueling/loading. One person conducts the fueling/loading, while the other stands by prepared to activate the fuel/chemical emergency shutoff and handle fire extinguishers if necessary. The aircraft should remain well clear of the fuel source, and at no time should the aircraft wing or helicopter blades extend over the fueling source.

- Before fueling, the aircraft must be bonded to the fuel source to equalize static electricity between the fuel source and the aircraft. Grounding of the aircraft and/or fuel truck is no longer recommended because it does not prevent sparks at the fuel source, and the grounding cable may not be sufficient to discharge the electrical current.

- All doors, windows, and access points allowing entry to the interior of the aircraft that are adjacent to, or in the immediate vicinity of, the fuel inlet ports should be closed and should remain closed during fueling operations.

- Fuel should be dispensed into an open port only from approved deadman-type nozzles, with a flow rate not to exceed 10 gallons per minute (38 liters per minute). Close port pressure fueling ports are preferable because the potential for spillage is reduced.

- A fire extinguisher of an appropriate type and size for the fueling operation must be within easy reach of ground personnel at all times during hot fueling operations. Operators who conduct hot fueling should also equip the aircraft with a fire extinguisher in the cockpit, if possible.

- When fueling/loading is complete, the pilot must ensure that the seatbelt and shoulder harness are properly re-secured as necessary prior to any aircraft movement.

- Operators should include this SAFO in initial and recurrent training programs for pilots and ground personnel.

**References:**
- Aeronautical Information Manual (AIM) – Helicopter Rapid Refueling,
- AC 00-34A, Aircraft Ground Handling and Servicing,
- National Fire Prevention Association (NFPA) 407, Standard for Aircraft Fuel Servicing,
- Include review of this SAFO in initial and recurrent training, and flight reviews.

**Contact:** Questions or comments concerning this SAFO can be directed to the General Aviation and Commercial Division, AFS-800, via phone at 202-267-8212.